University of Chester

Department of Clinical Sciences and Nutrition

Master of Science in Exercise and Nutrition Science

Research Project

THE RELATIONSHIP BETWEEN NUTRITION BEHAVIOUR AND PHYSICAL ACTIVITY LEVELS ON BODY MASS INDEX IN STUDENTS OF THE UNITED KINGDOM

Research Supervisor: Professor Stephen Fallows
Module Code: XN7523

Fadime Merve Oguz
Student Number: 1622508

September 2017

Total Word Count:
Literature Review: 4200
Research Project Report:4060

Portfolio Contents

I. Declaration

This work is original and has not been submitted in relation to any other degree of qualification.

Fadime Merve Oguz

Signed:

Date: 02/08/2017

Example Citation: Oguz, F. M., (2017). *The Relationship Between Nutrition Behaviour and Physical Activity Levels on Body Mass Index in Students of the United Kingdom* (Unpublished master's thesis), University of Chester, United Kingdom.

II. Acknowledgements

I would like to give special thanks to my academic supervisor, Professor Stephen Fallows for supporting and inspiring me throughout this Masters qualification. I would also like to thank the participants of the study for their time and dedication.

I would like to dedicate my thesis to my family and husband Dorukhan. Without their incredible and continuous support and encouragement, I would not be able to succeed**.**

III. List of Tables and Figures

Literature Review

Research Project Report

IV. List of Abbreviations

Abbreviations	Full title
ALSPAC	Avon longitudinal study of parents and children
B	Breakfast
BMI	Body mass index
BMR	Basal metabolic rate
BS	Breakfast skipping
CG	Control group
CI	Confidence interval
CRP	C-reactive protein
DED	Dietary energy density
DI	Diet
DM	Diabetes mellitus
EXE	Exercise
F	Female
FFQ	Food-frequency questionnaire
HED	High-energy-dense
HYHEP	Help your heart eating plan
I1	Intervention 1
I2	Intervention 2
I3	Intervention 3
IPAQ	International physical activity questionnaire
L	Lunch
M	Male
MET	The metabolic equivalent of task
NCEP	National cholesterol education programme
NDNS	The national diet and nutrition surveys
NHANES	National health and nutrition examination survey
NHS	Nurses' health study
NR	Not reported
SPSS	The statistical package for the social sciences
STATA	Data analysis and statistical software
TMS	Total meal skipping
TV	Television
WC	Waist circumference

LITERATURE REVIEW

THE RELATIONSHIP BETWEEN NUTRITION BEHAVIOUR AND PHYSICAL ACTIVITY LEVELS ON BODY MASS INDEX

Abstract

Sedentary lifestyles and unhealthy eating behaviours contribute to obesity, and the period between adolescence and early adulthood is accompanied by lifestyle changes that make young adults physically less active. Eating habits and physical activity levels of individuals are thought to be influenced by many factors. These factors should help to define their health status by health professionals. Unhealthy diet, such as high energy density food consumption, unhealthy food consumption, frequent snack consumption, eating disorders, frequent fast food consumption, television viewing while eating, skipping meals (especially breakfast), lack of fruit and vegetable consumption contribute to obesity. Concurrent reductions in energy expenditures are due to increasing trends in access to labour-saving technologies, in part, from reductions in household work, occupational, physical activity and active transport levels. Also, globally, increases in the prevalence of obesity tend to follow correlated economic, social and environmental shifts that affect both sides of the energy balance equation. However, all of these situations, unfortunately, set the stage for the increase of obesity and chronic diseases today. It is known that proper diet behaviours and adequate physical activity reduce the risk of chronic diseases and obesity. Health professionals need to identify all the factors that cause obesity and take the necessary precautions.

Introduction

Despite efforts to encourage people to keep a healthy diet and participate in regular physical activities, few people do. It is estimated that approximately seventy-nine percent of adults in the United States do not have adequate daily physical activity and ninety-one percent of adults do not eat enough vegetables (CDC, 2016; Moore & Thompson, 2015). Similarly, according to the World Health Organization, obesity rates have doubled since 1980, and more than 600 million people have been found to have obesity defined by body mass index above 30 kg/m^2 (World Health Organization, 2015). In 2050, it is predicted that obesity will affect sixty percent of adult males, fifty percent of adult females and twenty-five percent of children (Gandy, 2013). There is a complex link between physical activity, diet and obesity, with small imbalances in energy intake and energy expenditure causing gradual changes in weight over time (Veerman, Barendregt, Beeck, Seidell & Mackenbach, 2007). These behaviours that cause obesity are significant contributors to the global burden of disease and cause at least 2.8 million deaths each year (Baysal et al., 2011; Cai, He, Song, Zhao & Cui, 2013).

Evidence shows that the proper dietary behaviour and adequate physical activity reduce the risk of the chronic diseases (Chapman et al., 2014). Sedentary lifestyles and excess energy intake contribute to overweight and obesity, and the period between puberty and early adulthood is accompanied by lifestyle changes that make young adults physically less active (Racette, Deusinger, Strube, Highstein & Deusinger, 2005). Data from the National Health Interview Survey (Caspersen, Pereira & Curran, 2000), which involved 10,645 males and females aged 12 to 21 years, and 43,732 men and women aged 18 years and older showed that participation in vigorous aerobic and strengthening activities declines progressively between the ages of 12 and 21 years (Caspersen et al., 2000).

Negative longitudinal and secular trends have been observed in the diet and physical activity behaviours of the young. Fruit and vegetable intakes decrease with age; fast food

consumption increases during adolescence. In addition, the amount and frequency of snacks and fast food consumption have increased over the past decade (De Vet, De Ridder & De Wit, 2011). Similarly, there has been a report on physical activity trends that shows that activity has fallen with age from youth to adulthood (Armstrong & Welsman, 2006; Van Mechelen, Twisk, Post, Snel & Kemper, 2000). Changes in physical activity and diet behaviours among young people depend on environmental characteristics that encourage excessive energy intake and discourage energy expenditure. The energy imbalance that elevates overweight is fuelled by an unsupportive environment, with ever enhancing portion sizes, highly palatable foods, and high availability of energy dense foods and lower accessibility of healthy alternatives. Life opportunities or conditions that contribute to increasing obesity for individuals are called obesogenic environments. (De Vet et al., 2011).

1. Energy balance

The first law of thermodynamics states that energy can not be created or destroyed; this dictates that, in humans, energy intakes must either be expended or stored. Energy intakes are a function of both volume and energy intensity of consumed foods and drinks (Nelson, Weinsier, Long & Schutz, 1992). Basal metabolic rate or resting metabolic rate, physical activity and thermogenesis determine the energy expenditure. Seventy-three percent of daily energy expenditure is used for basal metabolic rate, fifteen percent for thermal effect and twelve percent for physical activity. Most of the energy is spent for basal metabolism (Şanlıer, 2005). BMR includes the energy required for normal metabolic processes when a body is resting (Nelson, Weinsier, Long & Schutz, 1992). Energy expenditure required for movement generated by the skeletal muscle is the most modifiable component of energy expenditure; the value depends on the activity volume and on the energy cost of that activity (Hill, Wyatt & Peters, 2012).

If an adult's energy intake (from food) is exactly equal to their energy expenditure (as internal and external work), they are in energy balance, and the total body energy content (and thus their fat stores) remains constant. If energy intake exceeds energy expenditure, there is a positive energy balance. An increase in body energy content means an increase in lean body mass (growth) or an increase in body fat stores, or both. Increasingly positive balance for the population implies an increase in fat stores leading to fatness. If the energy expenditure exceeds the intake, negative energy balance occurs. Individuals with negative energy balance lose body energy, and this is reflected in weight loss (Webb, 2008).

Obesity is identified regarding body mass index (BMI), which is a measure of relative weight for height and a representative measure of excess fat, defined as BMI= weight(kg)/height(m^2) (measured in indoor clothing and without shoes) (Gandy, 2013). The World Health Organization classification of obesity in adults is shown in Table -1.

Table-1 Body Mass Index (BMI) classification of World Health Organization

Classification	**BMI(kg/m^2)**	
	Principal cut-off points	Additional cut-off points
Underweight	<18.50	<18.50
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49
Normal range	18.50 - 24.99	18.50 - 22.99
		23.00 - 24.99
Overweight	≥25.00	≥25.00
Pre-obese	25.00 - 29.99	25.00 - 27.49
		27.50 - 29.99
Obese	≥30.00	≥30.00
Obese class I	30.00 - 34.99	30.00 - 32.49
		32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49
		37.50 - 39.99
Obese class III	≥40.00	≥40.00

Source: In 2017, World Health Organisation published on their website http://apps.who.int/bmi/index.jsp?introPage=intro_3.html

Increasing body weight by over twenty percent increases hypertension, coronary heart disease, hyperlipidemia and Type 2 diabetes risk. Metabolic disorders that occur when these are piled up are identified as "Metabolic Syndrome" (Baysal et al., 2011).

2. Factors influencing nutrition behaviour and physical activity

Eating behaviour is thought to be affected by both internal and external cues (Berthoud, 2012; Hussain & Bloom, 2013). Two systems have been identified to help regulate consumption (Hussain & Bloom, 2013). The first system is the homeostatic system, in which neural, nutrient and hormonal signals permit communication between the gut, liver, pancreas, brain stem, adipose tissue, and hypothalamus. The second internal system is a hedonic system regulated by the corticolimbic system that is affected by hedonic ("liking") and rewarding ("wanting") quality foods (Berthoud, 2012; Hussain & Bloom, 2013). The hedonic system has a great impact on consumption, as is indicated in situations when consuming occurs after reports of satiation and when there is no nutrition need (e.g., the dessert effect) (Berthoud, 2012). It is thought that cross-talk between these two internal systems has taken place; however, little is known about this process (Hussain & Bloom, 2013). Many external factors influence consumption of food. It has been shown that when availability, energy density, variety, and portion size increase, intake is heightened (Berthoud, 2012).

As with nutrition behaviour, physical activity from moderate to severe intensity is influenced by internal and external factors (Franco et al., 2015). Internally, physical limitations and discomfort, the mood of individuals impact their physical activity levels (Williams, Dunsiger, Jennings & Marcus, 2012; Franco et al., 2015). As the external factors, different physical environmental dimensions, such as walkability, safety, land use, public transportation availability, and aesthetics, in residential and/or work neighbourhoods have also been demonstrated to affect physical activity (Feuillet et al., 2015).

Globally, increases in the prevalence of obesity tend to follow interrelated economic, social and environmental shifts that affect both sides of the energy balance equation. Economic development in general increases the total food availability of energy-intensive products such as added sugars, refined grains and animal foods (Malik, Willett & Hu, 2013). Concurrent reductions in energy expenditures are due to increasing trends in access to labour-saving technologies, in part, from reductions in household work, occupational, physical activity and active transport levels (Ng & Popkin, 2012).

3. The relationship between nutrition behaviours, physical activity levels and body mass index (BMI)

3.1. The effect of physical activity levels on BMI

The results obtained from a prospective study aiming to examine moderate-vigorous physical activity, measured objectively (accelerometry) from childhood to adolescence and from adolescence to young adulthood, show that moderate-vigorous physical activity declines during the study period, more markedly from childhood to adolescence (overall change=30 min/d) than from adolescence to young adulthood (overall change=13 min/d) (Ortega et al., 2013). Over the past years, there is convincing evidence that per capita energy intakes have fallen significantly in the United Kingdom. The National Diet and Nutrition Surveys (NDNS) indicate that (Webb, 2012), between 1986-1987 and 2009, the average daily energy intake for men declined from 10.26 MJ (2450 kcal) to 9.48 MJ (2255 kcal); It was observed that there was very little change in women between 7.0 MJ (1680 kcal) and 6.92 MJ (1645 kcal). Despite this drop in daily energy intake, the only explanation for the increase in the number of overweight and obese people appears to be that activity levels have fallen sharply. It can be observed that the fall in intake has lagged behind the fall in expenditure (Webb, 2012).

Television viewing is now the most popular activity in recreational activities in most industrialized countries (Webb, 2012). Helajärvi, et al. (2014) evaluated changes in TV time,

waist circumference (waist) and body mass index (BMI) in participants (761 women, 626 men aged 33–50 years in 2011). Waist and BMI were measured, and TV time was self-reported in 2001, 2007, and 2011. It is discovered that television time is correlated to weight gain and constantly low television time was associated with less pronounced increase in BMI and BMI increase was lower with decreased television time. The increase in BMI was at least two-fold in the high TV time group compared to the low TV time group ($p<0.05$). In New Zealand, Hancox et al. (2004) found that 1000 children followed a 26-year follow-up and average weeknight viewing between ages 5 and 15 years was associated with higher body-mass indices ($p=.0013$) and was associated with other negative health indicators.

3.1.1. The role of the only exercise on BMI

Many studies examining the contribution of exercise to weight loss programme have concluded that exercise is only modestly contributing to weight loss. However, there is evidence that an exercise component increases the chances of long-term success; that is, it helps to prevent quick regain of loss weight (Webb, 2012). Shaw et al. (2006) performed a meta-analysis of forty-three weight-reduction controlled trials involving increased physical activity as one of the treatments. Exercise resulted in minor weight loss compared with no treatment, but when combined with a reduced diet, caused more weight loss than the diet alone. Increased exercise intensity increased the amount of weight loss. In these studies, exercise also caused significant changes in various risk factors for cardiovascular disease: decreased blood pressure, decreased blood triacylglycerol concentrations, and decreased fasting blood sugar. High-intensity exercise resulted in greater changes in these risk factors. There are many studies in which exercise plus diet interventions are used instead of diet interventions to reduce body weight; some of which are summarized in Table-2.

Table-2 The studies showed that the effect of diet and diet-plus-exercise on BMI and weight status

Reference	**n**	**Sex**	**Mean age**	**Mean BMI (kg/m^2)**	**Dietary intervention**	**Exercise programme**	**Duration of the active intervention**	**Follow-up after intervention**	**Population**
(Williams, Krauss, Stefanick, Vranizan & Wood, 1994).	76	M	37	30.5	NCEP step 1 diet	Aerobic exercise (brisk walking and jogging), 25–45 min, reached 60–80% of the maximal heart rate, three times per week	12 months	0	Obese men
(Skender et al., 1996)	36	M & F	35	35	HYHEP diet (low-energy eating plan)	Supervised weekly although group, brisk walking at a level of felt 'vigorous' not 'strenuous', 45 min, 4–5 times per week	12 months	12 months	Obese subjects
(Wing, Venditti, Jakicic, Polley & Lang, 1998)	77	M & F	45.5	36	Low-calorie and low-fat regimen with 20% of calorie plus fat at 800–1000 kcal d-1 during week 1–8 and gradually adjusted to 1200–1500 kcal d-1 after week 16	Supervised by exercise physiologists weekly in a group. Mainly brisk walking, 3 miles, five times per week, total activity gradually increased to 1500 kcal per week	24 months	0	Non-diabetic subjects with parental history of diabetes

Table-2 The studies showed that the effect of diet and diet-plus-exercise on BMI and weight status

Reference	**n**	**Sex**	**Mean age**	**Mean BMI (kg/m^2)**	**Dietary intervention**	**Exercise programme**	**Duration of the active intervention**	**Follow-up after intervention**	**Population**
(Fogelholm, Kukkonen-Harjula, Nenonen & Pasanen, 2000).	82	F	35	34	Low-fat diet	Supervised weekly in a group, reached 50–60% of maximal heart rate, included two groups: (1) walking, expended 4.2 MJ per week; and (2) walking, expend 8.4 MJ per week	13 months	11 months	Premenopausal women
(Brekke, Jansson & Lenner, 2005)	49	M & F	43	25.5	Nordic nutrition recommendation*** plus low-glycemic index foods	Increased physical activity (walking or other activity), _30 min, 4–5 times per week. Supervised intervention was through group discussions. Intensive follow-up was conducted in the first 4 months by a 72-h physical activity recall every 10 d; less intensive follow-up was performed after 4 months (recall every 10 weeks)	12 months	12 months	First degree relatives of type II diabetes
(Heilbronn et al., 2006)	36	M & F	37.5	27.5	25% calorie restriction diet based on American Heart association recommendations (30% fat)	Supervised weekly in a group, increased 12.5% energy expenditure (walking, running, cycling) 5 d per week	6 months	0	Overweight adults

Table-2 The studies showed that the effect of diet and diet-plus-exercise on BMI and weight status

Reference	**n**	**Sex**	**Mean age**	**Mean BMI (kg/m^2)**	**Dietary intervention**	**Exercise programme**	**Duration of the active intervention**	**Follow-up after intervention**	**Population**
(Fayh, Lopes., da Silva, Reischak-Oliveira & Friedman, 2013).	48	M&F	31.4 (DI) 32.3 (DI+ EXE)	34.7 (DI) 34.7 (DI+ EXE)	The reduction from 500 to 1,000 kcal/day energy needs of the subject. Balanced and rich in fiber, according to current Brazilian guidelines for the treatment of obesity	Three times a week, the stationary bicycle, during 45 minutes, at a 70 % intensity of the heart rate reserve.	Maintained until 5 % of the initial body weight was lost	0	Obese adults

Abbreviations: NCEP step 1 diet: less than 30% of energy from total fat, <10% of energy from saturated fat, >10% of energy from polyunsaturated fat, up to 10–15% of energy from monounsaturated fat, 50–60% of energy from carbohydrate, 10–20% of energy from protein and <200 mg of cholesterol per day.
HYHEP diet: help your heart eating plan. A low-cholesterol eating plan with energy intake of 30% from fat, 50% from carbohydrate and 20% from protein.
***Nordic Nutrition recommendations: 10% of energy from saturated fat, increase intake of monounsaturated fat and *n*-3 fatty acids, 50–60% of energy from carbohydrate and 10–20% from protein, <300 mg of cholesterol per day.
BMI, body mass index; F, female; M, male; NCEP, national cholesterol education programme; DI, diet; EXE, exercise.
(Adapted from Wu, Gao, Chen, & Van Dam, 2009).

Table-3 Weight loss differences between diet-plus-exercise group and diet-only group at the end of follow-up

Study	Intervention (months)	Total Duration	Diet +Exercise	Diet	Differences
BMI					
(Williams, Krauss, Stefanick, Vranizan & Wood, 1994).	12	12	-2.80 kg/m^2	-1.50 kg/m^2	-1.30 kg/m^2
Weight					
(Skender et al., 1996)	12	24	-2.20 kg	0.90 kg	-3.10 kg
(Wing, Venditti, Jakicic, Polley & Lang, 1998)	14.5	14.5	-7.90 kg	-3.80 kg	-4.10 kg
(Fogelholm, Kukkonen-Harjula, Nenonen & Pasanen, 2000).	13	24	-7.50 kg	9.70 kg	-2.20 kg
(Brekke, Jansson & Lenner, 2005)	12	24	-1.90 kg	-0.08 kg	-1.82 kg
(Heilbronn et al., 2006)	6	6	-8.00 kg	-8.00 kg	0 kg
(Fayh, Lopes., da Silva, Reischak-Oliveira & Friedman, 2013).	Maintained until 5 % of the initial body weight was lost	Maintained until 5 % of the initial body weight was lost	-4.7 kg	-4.31 kg	-0.39 kg

(Adapted from Wu, Gao, Chen, & Van Dam, 2009).

In 2000, Fogelholm, Kukkonen-Harjula, Nenonen, and Pasanen, found that the interventions were initiated after an intensive weight loss intervention in the weight maintenance phase and did not lead to further weight loss. Except from that, it is determined that diet-plus-exercise intervention are more effective in reducing body weight and BMI than diet intervention in many studies (Williams, Krauss, Stefanick, Vranizan & Wood, 1994; Skender et al., 1996; Wing, Venditti, Jakicic, Polley & Lang, 1998; Brekke, Jansson & Lenner, 2005; Fayh, Lopes., da Silva, Reischak-Oliveira & Friedman, 2013).

3.2. The effects of nutrition behaviour on BMI

Unhealthy eating habits are one of the most important reasons that lead to obesity and impair the quality of life. Genetic predisposition, unhealthy nutrition behaviours such as skipping meals, consuming high-fat snacks among meals, inappropriate cooking methods, excess alcohol consumption, inadequate water and fibre consumption have an effect on obesity (Seidell, 1998; Yurttagül, 1995). Primary factors on poor nutrition habits of young people; the choices of personal eating, meal pattern of the family, the model of mother and father's choice of eating, the media and society norms (Neumark-Sztainer, French, Hannan, Story & Fulkerson, 2005). However, personal factors which affect eating habits; beliefs, self-esteem, meal and snack patterns are influential in weight control. The social, environmental factors, which affect eating habits are family, friends (Story, Neumark-Sztainer & French, 2002). Therefore, eating behaviour is central to the physical development, health and personality of young adults. The nutritional habits and behaviours to be earned at an early age are an important determinant in food selection, quality of life and health protection (Martens, Van Assema & Brug, 2005). Changes in eating behaviour are independently associated with long-term weight changes. Particularly, behaviours such as skipping meals, drinking sweetened beverages, snacking, and consuming fast food were frequently studied as potential contributors to obesity (Pereira et al., 2005; Barnes, French, Mitchell & Wolfson, 2016).

3.2.1. The effect of dietary energy density on BMI

Many of studies were conducted to examine the effect of nutrition behaviour on BMI. Among dietary factors, dietary energy density (DED), a measure of the overall diet, has been the focus of many new investigations (see Table-4) (Richter et al., 2012). The Western diet is predominantly loaded by high energy dense foods and is known as an "obesity-inducing diet pattern". High energy density diets are rich in fat and energy but are low in fibre, fruit and vegetables. For this reason, the link between dietary energy density and body mass index was examined in various epidemiological and intervention studies in different age groups (see Table-4) (Rouhani, Haghighatdoost, Surkan & Azadbakht, 2016).

Table- 4 The studies showed that the effect of dietary energy density on obesity markers and risk of obesity

Reference	Design/ follow-up (y)	Dietary assessment tool	Main study/country	N of subjects (male:female)	Age (y)	DED (lowest:highest category) (kcal/g)	Method of calculating DED*	Reported or extracted data	Multivariable adjusted model or crude model	Result
(Ambrosini et al., 2012)	Cohort/8	Dietary record	UK Avon Longitudinal Study of Parents and Children/England	2245 (NR:NR)	11	NR	Foods and beverages	BMI, fat mass index and risk of obesity	Multivariable adjusted	A direct association between consuming HED diet and fat mass index was observed.
(Bes-Rastrollo et al., 2008)	Cohort/8	FFQ	NHS II/US	50026 (0:50026)	36.5	(0.78:2.46)	Solid foods only	Weight, weight change, and BMI	Multivariable adjusted	There was a significant association between DED and weight gain.
(Hartline-Grafton, Rose, Johnson, Rice & Webber, 2009)	Cross-sectional/-	Dietary recall	-/US	232 (0:232)	>18	(1.39:2.37)	Solid foods only	BMI	Crude	There was an increasing trend for BMI across tertiles of DED
(Howarth, Murphy, Wilkens, Hankin & Kolonel, 2006)	Cross-sectional/-	FFQ	Hawaii-Los Angeles Multiethnic Cohort/US	191023 (86713:104310)	60	NR	Foods and beverages	Risk of obesity	Multivariable adjusted	There was a direct association between DED and risk of obesity.

Table- 4 The studies showed that the effect of dietary energy density on obesity markers and risk of obesity

Reference	Design/ follow-up (y)	Dietary assessment tool	Main study/country	N of subjects (male:female)	Age (y)	DED (lowest:highest category) (kcal/g)	Method of calculating DED*	Reported or extracted data	Multivariable adjusted model or crude model	Result
(McCaffrey et al., 2008)	Cohort/8	Dietary record	-/England	48 (30:18)	7	NR	Both methods	Risk of obesity	Multivariable adjusted	The association between DED and risk of obesity was dependent on the method of DED calculation
(Murakami, Miyake, Sasaki, Tanaka & Arakawa, 2012)	Cross-sectional/-	Diet-history questionnaire	Ryukyus Child Health Study/Japan	24176 (11900:12276)	10.5	(1.00:1.41)	Solid foods only	Risk of obesity	Multivariable adjusted	There was a positive association between DED and risk of overweight among male children.
(Murakami, Sasaki, Takahashi & Uenishi, 2007).	Cross-sectional/-	Diet-history questionnaire	-/Japan	1136 (0:1136)	19.6	(1.16:1.67)	Solid foods only	BMI and WC	Multivariable adjusted	There was a positive association between DED, BMI, and WC.
(Johnson, Mander, Jones, Emmett & Jebb, 2008).	Cohort/3	Dietary record	ALSPAC/England	430 NR	7	NR	Solid foods only	Excess adiposity	Multivariable adjusted	There was a positive association between DED at age 7 y and risk of excess adiposity.

ALSPAC, Avon Longitudinal Study of Parents and Children; BMI, body mass index; DED, dietary energy density; FFQ, food-frequency questionnaire; HED, high-energy-dense; NR, not reported; NHS, Nurses' Health Study; WC, waist circumference
* Two methods were considered: solid foods only and foods and beverages.
(Source: Rouhani, Haghighatdoost, Surkan, & Azadbakht, 2016).

It is found that more dietary energy density in the cohort and cross-sectional studies are directly related to weight gain, adjusted means for BMI (separately for males and females) and adiposity risk (Ambrosini et al., 2012; Bes-Rastrollo et al., 2008; Hartline-Grafton, Rose, Johnson, Rice & Webber, 2009; Howarth, Murphy, Wilkens, Hankin & Kolonel, 2006; McCaffrey et al., 2008; Murakami, Miyake, Sasaki, Tanaka & Arakawa, 2012; Murakami, Sasaki, Takahashi & Uenishi, 2007; Johnson, Mander, Jones, Emmett & Jebb, 2008).

3.2.2. The effect of diet pattern on BMI

A 2017 study by Heerman et al. examined how a wide range of eating behaviours are related to body mass index. Overall diet quality, the frequency of eating healthy food, the frequency of eating unhealthy food, the frequency of snacking, and problem eating behaviours of 11,776 adult patients were investigated and calculated BMI from self-reported height and weight data. The patients were considered as the participants to improve their healthy eating behaviours through individual dietary counselling and public health initiatives. Four eating styles were classified and determined by healthy vs. unhealthy diet patterns and engagement in problem eating behaviours. Figure-1 shows that, unhealthy with problem eating group had a significantly higher average BMI than unhealthy eating group ($P<.001$), and healthy with problem eating group ($P<.001$).

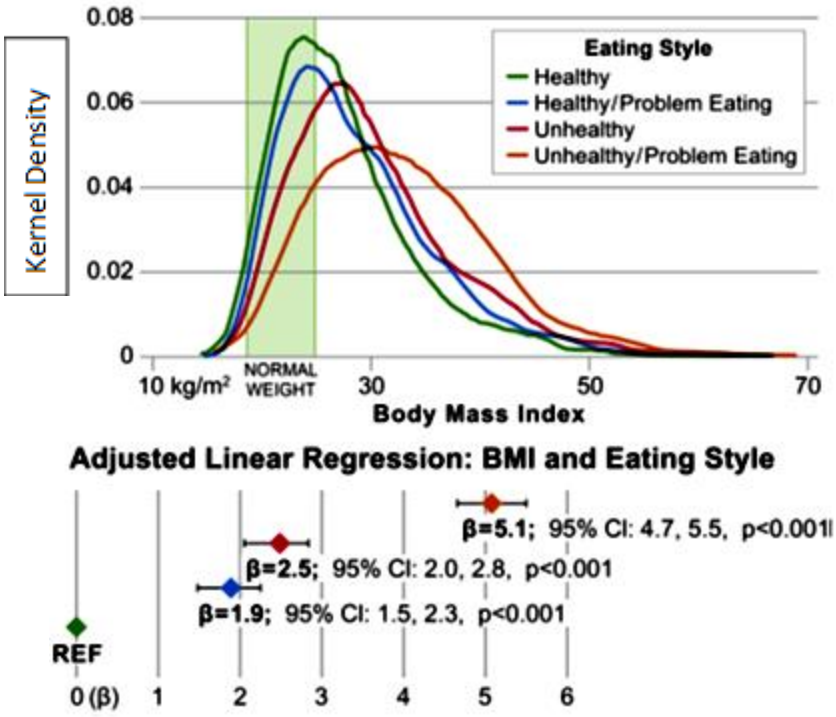


Figure-1 Distribution of body mass index by eating style. Distribution of body mass index (BMI) as measured by kernel density according to cluster of eating behaviour. The default STATA (version 14.2; StatCorp, College Station, Texas) settings for kernel density were used, including the Epanechnikov kernel and the calculated optimal bandwidth of the kernel. The inset figure shows the adjusted b and 95% confidence interval (CI) from the linear regression evaluating the association between eating cluster and BMI, controlling for age, gender, household income, race/ethnicity, and physical activity. The referent group is the healthy eating cluster. (Source: Heerman, et al., 2017).

3.2.3. The effect of fast food consuming frequency on BMI

Fast food outlets in the United States reached about 30,000 in 1970, more than 233,000 in 2004, and were classified as the fastest growing sector of the United States food distribution system. It can be described as convenience food purchased in self-service or carry-out eating places without wait service (Rosenheck, 2008). Specifically, fast food is energy intensive, weak in terms of micronutrients, low in fibre, high in glycemic load, and prone to excess in portion

sizes; which in turn generally causes to exceed daily energy requirements (Pereira et al., 2005; Isganaitis & Lustig, 2005). For this reason, there are some studies investigating the relationship between BMI and fast food consumption.

Between 1985-86 and 2000-01, it is recorded strong positive relationships between frequency of visits to fast food restaurants and body weight increases in young black male and female black adults living in the United States. By comparison with the average 15-year weight gain in participants with infrequent fast food restaurant use at the year 2000 and follow-up, those with frequent fast food restaurant use at both baseline and monitoring gained an extra 4-5 kg body weight. Relationships seemed largely independent of other potentially confounding lifestyle factors such as physical activity and television viewing (Pereira et al., 2005).

3.2.4. The effect of watching television while eating on BMI

Lengthier TV viewing is associated with the increased body mass index (BMI), cardiovascular disease and increased risk of type II diabetes (Braude & Stevenson, 2014). Prospective studies show that watching more TV in young people predicts more weight gain and poorer physical health in the coming years (Wijndaele et al., 2010). TV viewing contributes to weight gain by possibly reducing energy consumption and increasing energy intake (Cleland, Schmidt, Dwyer & Venn, 2008; Goris, Petersen, Stamatakis & Veerman, 2010). The distracting capacity of TVs means that people who watch TV are not paying attention to the various signals that normally show that a meal is over; thus, reaching more eating outcome. (Smith & Ditschun, 2009). In terms of energy intake, TV viewing may serve as a general marker for a poor diet; it may increase exposure to unhealthy food advertisements and displace sleep. (Braude & Stevenson, 2014).

3.2.5. The effect of eating frequency on BMI

Irregular nutrition is a common practice in overweight and obese patients. Skipping breakfast is associated with obesity risk in many studies (see Table-5) (Cho, Dietrich, Brown, Clark & Block, 2003; Song, Chun, Obayashi, Cho & Chung, 2005; Aryee, Helegbe, Baah, Sarfo-Asante & Quist-Therson, 2013; Colić Barić, Šatalić & Lukešić, 2003) and it is more likely that those who successfully prevent weight regain are regular breakfast eaters (Wyatt et al., 2002). Regular breakfast consumption can be beneficial by reducing impulsive snacking and reducing food intake at subsequent meals (Martin et al., 2000).

Table-5 The studies showed the relationship between the eating frequency and BMI

Reference	**Design**	**Sample characteristics, N (% women)**	**Participants; age, years (mean ± SD)**	**How was meal skipping measured?**	**Definition of meal skipping**	**Frequency of meal skipping**	**Correlates of meal skipping**	**Result**
(Aryee, Helegbe, Baah, Sarfo-Asante & Quist-Therson, 2013).	Cross-sectional	Nurses; 220; (66% F)	20–60 years; (67.3% 20–30 years)	Q: Do you meal skip? (Yes/No)	"Yes"	53.6% skipped meals	BMI:(+TMS)	A positive significant association between meal skipping and BMI (p=0.002)
(Colić Barić, Šatalić & Lukešić, 2003).	Cross-sectional	University students; 2075 (53% F)	21.7 ± 2.0 years	Specially designed FFQ	Numerical ; Regular B, defined as having B 6 or 7 times per week	B consumed on 3.4 days/week, L 6 days/week, D 4.7 days/week. 32.2% F and 25.7% M consumed B regularly	BMI: (+BS)	Students who had regular breakfast, when compared with students that never had breakfast, had significantly lower BMI (p<0.05).

Abbreviations: M, males; F, females; B, breakfast; L, lunch; D, dinner; BMI, body mass index; FFQ, food frequency questionnaire; BS, Breakfast skipping; TMS, Total meal skipping; (0) = No association, (+) = Positive association, (-) = Negative association

(Source: Pendergast, Livingstone, Worsley, & McNaughton, 2016).

A 2003 study by Ma et al. reported that skipping meals is associated with a high risk of overweight and obesity. Obviously, skipping meals, especially breakfast, it is an improper eating habit (Rashidi et al., 2007). Positive correlations were found between BMI and meal skipping on young adults (see Table-5) (Aryee, Helegbe, Baah, Sarfo-Asante & Quist-Therson, 2013; Colić Barić, Šatalić & Lukešić, 2003). Evidence of skipping meals such as breakfast is not only associated with obesity, but also leads to undernutrition due to limited food intake (Nicklas, Myers, Reger, Beech & Berenson, 1998). Thus, skipping of meals are likely to produce a poorly diversified diet that may come as part of the nutritional transition associated with the pressure of urbanization and increased workload (Aryee, Helegbe, Baah, Sarfo-Asante & Quist-Therson, 2013).

3.2.6. The relationship between the quality of diet and obesity

Deficiencies of micronutrients due to lack of fruit and vegetable consumption have recently attracted attention in obese individuals. Improving the intake of fruits, vegetables and whole grains and modifying fatty acid composition is known to have a positive effect on cardiovascular health, type 2 diabetes and risk factors for certain types of cancer, independent of weight loss (Pearson & Grace, 2012). Second, there is increasing evidence that obese populations are at increased risk for micronutrient deficiencies compared to the general population; in one study, forty-seven percent of obese individuals waiting for bariatric surgery had at least one of the most common micronutrient deficiencies (Ernst, Thurnheer, Schmid & Schultes, 2009). Although it seems paradoxical that an excess calorie intake could occur in parallel with an inadequate micronutrients intake, serious vitamin and mineral deficiencies are found in the obese, and poor diet quality may be one possible explanation (Pearson & Grace, 2012).

3.2.7. The relationship between eating disorders and BMI

Overweight adolescents are at risk for weight-related physical and psychosocial problems. Although many physical risks are not noticeable until adulthood, psychosocial outcomes may start early in life, be difficult to manage, and have long-term psychological effects. Overweight adolescents may be at higher risk of using unhealthy weight control strategies than regular weight adolescents. They may have failed to lose weight by using diet and exercise, and they may believe that these unhealthy weight control strategies are the last hopes (Boutelle, Neumark-Sztainer, Story & Resnick, 2002). Research has shown that overweight male and female adolescents are at a higher risk for diet and binge eating (Neumark-Sztainer et al., 1997; Neumark-Sztainer, Story, Falkner, Beuhring & Resnick, 1999). Overweight female adolescents are more often confronted with healthy weight control behaviours (healthy eating and exercise)

and unhealthy weight control behaviours (hunger, laxative / diuretic use, diet pill use, vomiting and excessive weight loss) compared to non-overweight female adolescents (Boutelle, Neumark-Sztainer, Story & Resnick, 2002).

4. The effect of years of college on BMI

In the first year of the university, weight gain was described as a problem for many students (Racette, Deusinger, Strube, Highstein & Deusinger, 2005). Lloyd-Richardson et al. (2009) discovered that the first year of university shows that many males and females are associated with a significant weight gain and that many students, especially males, continue to gain weight in the second year. However, they did not research the factors that contributed to weight gain during college years. Racette et al. (2005) examined the weight loss, exercise and nutrition patterns of 764 students of Washington University (53% female, 47% male) in first and second-year students. At the beginning of the first year, twenty-nine percent of the students reported that they did not exercise, seventy percent of them eat less than five fruits and vegetables a day, and more than fifty percent eat fried or fatty fast food at least three times a week. At the end of the second year, seventy percent of the two hundred nine re-assessed students had gained weight (4.1 ± 3.6 kg, $p < .001$) but there was no significant relationship with exercise or diet patterns. The nutrition questionnaire may be questions of the behaviours of the participants in the previous week, which may not have represented the diet models during freshman and sophomore years (Racette, Deusinger, Strube, Highstein & Deusinger, 2005). On the other hand, a prospective study by Racette et al. (2008) discovered that females gained 1.7 ± 4.5 kg from freshman to senior year, and males gained 4.2 ± 6.4 kg (both $p < .001$) and self-reported physical activity and dietary behaviours did not meet the recommended levels for many students in the present study, which may have negative health consequences independent of the potential contribution to weight gain.

5. The role of diet and exercise on BMI

Calorie intake and physical activity frequency and intensity are the main determinants of energy balance. However, both weight loss and the maintenance of healthy weight are ensured through a sustained commitment to healthy nutrition (e.g., increased fruit/vegetable consumption) and physical activity (e.g., reduced sedentary time) in a broader range (Heerman et al., 2017). The effect of physical activity plus diet on BMI were summarized in the Table-6.

Table-6 Characteristics of the studies showed that the effect of diet plus exercise on BMI

Reference	**n**	**Sex**	**Mean age**	**Mean BMI (kg/m^2)**	**Dietary intervention**	**Exercise programme**	**Duration of the active intervention**	**Follow-up after intervention**	**Population**
(Bo et al., 2007)	375	M&F	55	29.7	written recommendation including individually prescribed diet	moderate-intensity activity, such as brisk walks for ar least 150 minutes/week. Sessions had a flexible structure, sensitive to cultural differences and patient expectations.	12 months	12 months	metabolic syndrome or metabolic syndrome + high-sensitivity CRP
(Oldroyd, Unwin, White, Mathers & Alberti, 2006).	78	M&F	58	-	a dietary fat intake of ≤30% of total energy intake, a polyunsaturated to saturated fat ratio of ≥1.0, 50% of energy from carbohydrate and a dietary fibre intake of ≥20 g per 4.2 MJ	20–30 min of aerobic activity at least once a week	24 months	24 months	The individuals with Impaired glucose tolerance
(Lindström et al., 2006)	522	M&F	55	31.1	Low fat, high-fiber diet; goal BMI <25 or 5-10kg weight loss; <50% carbohydrate,<30% fat,<300 mg / day cholesterol	moderate activity 30 minutes / day; supervised strength training; frequency and availability varied among study centers.	38 months	12 months	The individuals with Impaired glucose tolerance and obesity

Table-6 Characteristics of the studies showed that the effect of diet plus exercise on BMI

Reference	n	Sex	Mean age	Mean BMI (kg/m^2)	Dietary intervention Exercise programme	Duration of the active intervention	Follow-up after intervention	Population
(Wing, Venditti, Jakicic, Polley & Lang, 1998).	154 I1: Exercise (37) I2: Exercise +diet (40) I3: Diet (37) CG: (40)	M&F	45	35.9	I1: encouraged to increase physical activity (e.g., walking 3 miles on each of 5 days in the week) in biweekly increments of 250 Kcal/week to achieve a goal of 1500 Kcal/week. I2: instructions and counselling similar to those for diet only and exercise only intervention groups. I3: reducing energy intake: 800-1,000 kcal/day, 20% of calories as fat, for weeks 1-8 then 1,200-1,500 kcal/day at week 16; both the diet and exercise interventions received behavioral therapy. CG: general written and oral information to lose weight and exercise on their own.	24 months	24 months	overweight subjects (30-100% of ideal body weight), aged 40-55 years, nondiabetic, and had one or two biological parents with DM.

Table-6 Characteristics of the studies showed that the effect of diet plus exercise on BMI

Reference	n	Sex	Mean age	Mean BMI (kg/m^2)	Dietary intervention Exercise programme	Duration of the active intervention	Follow-up after intervention	Population
(Foster-Schubert et al., 2012).	439	F	58	30.9	Total daily energy intake of 1,200–2,000 kcal/day based on baseline weight, <30% daily energy intake from fat, and a 10% reduction in body weight by 6 months with maintenance thereafter to 12 months. ≥45 min of moderate-to-vigorous intensity exercise, 5 days/week (225 min/week) for 12 months	12 months	-	overweight-to-obese postmenopausal sedentary women

Abbreviations: I1, intervention 1; I2, intervention 2; I3, intervention 3; CG, control group; DM, diabetes mellitus; CRP, C-reactive protein; BMI, body mass index; F, female; M, male; NCEP, national cholesterol education programme
(Source: Orozco, 2008)

Table-7 Exercise plus diet versus standard recommendations (overall analysis), Mean differences between groups in body mass index (BMI - kg/m^2) and body weight (kg).

Reference	**Intervention (months)**	**Total Duration**	**Diet +Exercise Mean**	**Control Mean**	**Differences**
(Bo et al., 2007)	12	24	-0.29 kg/m^2	0.61 kg/m^2	-0.90 kg/m^2
(Oldroyd, Unwin, White, Mathers & Alberti, 2006)	24	48	-0.69 kg	0.91 kg	-1.60 kg
(Lindström et al., 2006)	38	50	-1.3 kg/m^2	-0.3 kg/m^2	-1.00 kg/m^2
(Wing, Venditti, Jakicic, Polley & Lang, 1998)	24	48	-0.8 kg/m^2	-0.1 kg/m^2	-0.70 kg/m^2
(Foster-Schubert et al., 2012)	12	12	-3.4 kg/m	0.61 kg/m^2	-4.01 kg/m^2

(Adapted from Orozco, 2008)

It was discovered that the BMI values of the diet plus exercise group fell significantly below the control group. It is discovered that diet plus exercise intervention decrease BMI (see Table-7).

6. The relationship between nutrition behaviour and physical activity

Some studies have been conducted to understand the relationship between individuals' physical activity and eating habits (Pearson & Biddle, 2011). Sedentary behaviour in adolescents has been found to be associated with less healthy diet components, and in particular with higher consumption of energy-intensive snacks and drinks and lower fruit and vegetable consumption (Marshall, Biddle, Gorely, Cameron & Murdey, 2004).

Young people consume a significant portion of their daily energy intake during television watching (Pearson & Biddle, 2011). Experimental studies showed that watching TV while eating can be distracting, causing delays in normal mealtime satiation and a decrease in internal satiety signals (Blass et al., 2006; Bellissimo, Pencharz, Thomas & Anderson, 2007). Consequently, it is discovered that sedentary behaviour is associated with unhealthy dietary habits in children, adolescents, and adults in mainly cross-sectional studies (Pearson & Biddle, 2011).

Conclusion

Genetic predisposition, social life, the years of college of students, physical activity levels, unhealthy nutrition behaviours such as skipping meals, consuming consistently high energy foods and fast foods, improper cooking methods, excess alcohol consumption, inadequate water and fibre consumption and watching television while eating are effective on obesity. Increasing level of physical activity and eating an adequate and balanced diet reduce body mass index.

Obesity and increasing frequency of metabolic syndrome are worrying. For this reason, it is necessary to determine the factors causing obesity and to take precautions. From the adolescence period, it is important for young people to be directed to a more active life in school, in society and under all conditions, for mental and physical health and a healthier life in the adulthood period. Health professionals, in particular, should have responsibilities to be a role model for a healthy lifestyle that includes adequate and balanced nutrition and regular exercise.

REFERENCES

Ambrosini, G. L., Emmett, P. M., Northstone, K., Howe, L. D., Tilling, K., & Jebb, S. A. (2012). Identification of a dietary pattern prospectively associated with increased adiposity during childhood and adolescence. *International Journal of Obesity*, *36*(10), 1299-1305.

Armstrong, N., & Welsman, J. R. (2006). The physical activity patterns of European youth with reference to methods of assessment. *Sports Medicine*, *36*(12), 1067-1086.

Aryee, P. A., Helegbe, G. K., Baah, B., Sarfo-Asante, R. A., & Quist-Therson, R. (2013). Prevalence and risk factors for overweight and obesity among nurses in the Tamale metropolis of Ghana. *Journal of Medical and Biomedical Sciences*, *2*(4), 13-23.

Barnes, T. L., French, S. A., Mitchell, N. R., & Wolfson, J. (2016). Fast-food consumption, diet quality and body weight: cross-sectional and prospective associations in a community sample of working adults. *Public Health Nutrition*, *19*(05), 885-892.

Baysal, A., Aksoy, M., Besler, H. T., Bozkurt, N., Keçecioğlu, S., Mercanlıgil, S. M., ... & Yıldız, E. (2011). *Diyet El Kitabı.* (6th ed.). Ankara: Hatipoğlu Yayınevi.

Bellissimo, N., Pencharz, P. B., Thomas, S. G., & Anderson, G. H. (2007). Effect of television viewing at mealtime on food intake after a glucose preload in boys. *Pediatric Research*, *61*(6), 745-749.

Berthoud, H. R. (2012). The neurobiology of food intake in an obesogenic environment. *Proceedings of the Nutrition Society*, *71*(04), 478-487.

Bes-Rastrollo, M., van Dam, R. M., Martinez-Gonzalez, M. A., Li, T. Y., Sampson, L. L., & Hu, F. B. (2008). Prospective study of dietary energy density and weight gain in women. *The American Journal of Clinical Nutrition*, *88*(3), 769-777.

Blass, E. M., Anderson, D. R., Kirkorian, H. L., Pempek, T. A., Price, I., & Koleini, M. F. (2006). On the road to obesity: television viewing increases intake of high-density foods. *Physiology & Behavior*, *88*(4), 597-604.

Bo, S., Ciccone, G., Baldi, C., Benini, L., Dusio, F., Forastiere, G., ... & Gentile, L. (2007). Effectiveness of a lifestyle intervention on metabolic syndrome. A randomized controlled trial. *Journal of General Internal Medicine*, *22*(12), 1695-1703.

Boutelle, K., Neumark-Sztainer, D., Story, M., & Resnick, M. (2002). Weight control behaviors among obese, overweight, and nonoverweight adolescents. *Journal of Pediatric Psychology*, *27*(6), 531-540.

Braude, L., & Stevenson, R. J. (2014). Watching television while eating increases energy intake. Examining the mechanisms in female participants. *Appetite*, *76*, 9-16.

Brekke, H. K., Jansson, P. A., & Lenner, R. A. (2005). Long-term (1-and 2-year) effects of lifestyle intervention in type 2 diabetes relatives. *Diabetes Research and Clinical Practice*, *70*(3), 225-234.

Cai, L., He, J., Song, Y., Zhao, K., & Cui, W. (2013). Association of obesity with socio-economic factors and obesity-related chronic diseases in rural southwest China. *Public Health*, *127*(3), 247-251.

Caspersen, C. J., Pereira, M. A., & Curran, K. M. (2000). Changes in physical activity patterns in the United States, by sex and cross-sectional age. *Medicine and Science in Sports and Exercise*, *32*(9), 1601-1609.

Center for Disease Control. (2016). National Center for Disease statistics. Retrieved from http://www.cdc.gov/nchs/fastats/exercise.htm.

Chapman, C. D., Nilsson, V. C., Thune, H. Å., Cedernaes, J., Le Grevès, M., Hogenkamp, P. S., ... & Schiöth, H. B. (2014). Watching TV and food intake: the role of content. *PLoS One*, *9*(7), e100602.

Cho, S., Dietrich, M., Brown, C. J., Clark, C. A., & Block, G. (2003). The effect of breakfast type on total daily energy intake and body mass index: results from the Third National Health and Nutrition Examination Survey (NHANES III). *Journal of the American College of Nutrition*, *22*(4), 296-302.

Cleland, V. J., Schmidt, M. D., Dwyer, T., & Venn, A. J. (2008). Television viewing and abdominal obesity in young adults: is the association mediated by food and beverage consumption during viewing time or reduced leisure-time physical activity? *The American Journal of Clinical Nutrition*, *87*(5), 1148-1155.

Colić Barić, I., Šatalić, Z., & Lukešić, Ž. (2003). Nutritive value of meals, dietary habits and nutritive status in Croatian university students according to gender. *International Journal of Food Sciences and Nutrition*, *54*(6), 473-484.

De Vet, E., De Ridder, D., & De Wit, J. (2011). Environmental correlates of physical activity and dietary behaviours among young people: a systematic review of reviews. *Obesity Reviews*, *12*(5), e130-e142.

Ernst, B., Thurnheer, M., Schmid, S. M., & Schultes, B. (2009). Evidence for the necessity to systematically assess micronutrient status prior to bariatric surgery. *Obesity Surgery*, *19*(1), 66-73.

Fayh, A. P. T., Lopes, A. L., da Silva, A. M. V., Reischak-Oliveira, A., & Friedman, R. (2013). Effects of 5% weight loss through diet or diet plus exercise on cardiovascular parameters of obese: a randomized clinical trial. *European Journal of Nutrition*, *52*(5), 1443-1450.

Feuillet, T., Charreire, H., Menai, M., Salze, P., Simon, C., Dugas, J., & ... Oppert, J. (2015). Spatial heterogeneity of the relationships between environmental characteristics and active commuting: towards a locally varying social ecological model. *International Journal of Health Geographics*, *14*(1), 1.

Fogelholm, M., Kukkonen-Harjula, K., Nenonen, A., & Pasanen, M. (2000). Effects of walking training on weight maintenance after a very-low-energy diet in premenopausal obese women: a randomized controlled trial. *Archives of Internal Medicine*, *160*(14), 2177-2184.

Foster-Schubert, K. E., Alfano, C. M., Duggan, C. R., Xiao, L., Campbell, K. L., Kong, A., ... & McTiernan, A. (2012). Effect of diet and exercise, alone or combined, on weight and body composition in overweight-to-obese postmenopausal women. *Obesity*, *20*(8), 1628-1638.

Franco, M. R., Tong, A., Howard, K., Sherrington, C., Ferreira, P. H., Pinto, R. Z., & Ferreira, M. L. (2015). Older people's perspectives on participation in physical activity: a systematic review and thematic synthesis of qualitative literature. *British Journal of Sports Medicine*, *49*(19), 1268.

Gandy, J. (2013). *Manual of Dietetic Practice* (5th ed.). Chichester: Wiley-Blackwell.

Goris, J. M., Petersen, S., Stamatakis, E., & Veerman, J. L. (2010). Television food advertising and the prevalence of childhood overweight and obesity: a multicountry comparison. *Public Health Nutrition*, *13*(07), 1003-1012.

Hancox, R. J., Milne, B. J., & Poulton, R. (2004). Association between child and adolescent television viewing and adult health: a longitudinal birth cohort study. *The Lancet*, *364*(9430), 257-262.

Hartline-Grafton, H. L., Rose, D., Johnson, C. C., Rice, J. C., & Webber, L. S. (2009). Energy density of foods, but not beverages, is positively associated with body mass index in adult women. *European Journal of Clinical Nutrition*, *63*(12), 1411-1418.

Heerman, W. J., Jackson, N., Hargreaves, M., Mulvaney, S. A., Schlundt, D., Wallston, K. A., & Rothman, R. L. (2017). Clusters of healthy and unhealthy eating behaviors are associated with body mass index among adults. *Journal of Nutrition Education and Behavior*, *49*(5), 415-421.

Heilbronn, L. K., de Jonge, L., Frisard, M. I., DeLany, J. P., Larson-Meyer, D. E., Rood, J., ... & Greenway, F. L. (2006). Effect of 6-month calorie restriction on biomarkers of longevity, metabolic adaptation, and oxidative stress in overweight individuals: a randomized controlled trial. *The Journal of the American Medical Association*, *295*(13), 1539-1548.

Helajärvi, H., Rosenström, T., Pahkala, K., Kähönen, M., Lehtimäki, T., Heinonen, O. J., ... & Raitakari, O. T. (2014). Exploring causality between TV viewing and weight change in young and middle-aged adults. The Cardiovascular Risk in Young Finns study. *PLoS One*, *9*(7), e101860.

Hill, J. O., Wyatt, H. R., & Peters, J. C. (2012). Energy balance and obesity. *Circulation*, *126*(1), 126-132.

Howarth, N. C., Murphy, S. P., Wilkens, L. R., Hankin, J. H., & Kolonel, L. N. (2006). Dietary energy density is associated with overweight status among five ethnic groups in the multiethnic cohort study. *The Journal of Nutrition*, *136*(8), 2243-2248.

Hussain, S. S., & Bloom, S. R. (2013). The regulation of food intake by the gut-brain axis: implications for obesity. *International Journal of Obesity*, *37*(5), 625-633.

Isganaitis, E., & Lustig, R. H. (2005). Fast food, central nervous system insulin resistance, and obesity. *Arteriosclerosis, Thrombosis, and Vascular Biology*, *25*(12), 2451-2462.

Johnson, L., Mander, A. P., Jones, L. R., Emmett, P. M., & Jebb, S. A. (2008). A prospective analysis of dietary energy density at age 5 and 7 years and fatness at 9 years among UK children. *International Journal of Obesity*, *32*(4), 586-593.

Lindström, J., Ilanne-Parikka, P., Peltonen, M., Aunola, S., Eriksson, J. G., Hemiö, K., & ... Tuomilehto, J. (2006). Articles: Sustained reduction in the incidence of type 2 diabetes by lifestyle intervention: follow-up of the Finnish Diabetes Prevention Study. *The Lancet*, (*368)*1673-1679.

Lloyd-Richardson, E. E., Bailey, S., Fava, J. L., Wing, R., & Tobacco Etiology Research Network. (2009). A prospective study of weight gain during the college freshman and sophomore years. *Preventive Medicine*, *48*(3), 256-261.

Ma, Y., Bertone, E. R., Stanek, E. J., Reed, G. W., Hebert, J. R., Cohen, N. L., ... & Ockene, I. S. (2003). Association between eating patterns and obesity in a free-living US adult population. *American Journal of Epidemiology*, *158*(1), 85-92.

Malik, V. S., Willett, W. C., & Hu, F. B. (2013). Global obesity: trends, risk factors and policy implications. *Nature Reviews Endocrinology*, *9*(1), 13-27.

Marshall, S. J., Biddle, S. J., Gorely, T., Cameron, N., & Murdey, I. (2004). Relationships between media use, body fatness and physical activity in children and youth: a meta-analysis. *International Journal of Obesity*, *28*(10), 1238-1246.

Martens, M. K., Van Assema, P., & Brug, J. (2005). Why do adolescents eat what they eat? Personal and social environmental predictors of fruit, snack and breakfast consumption among 12–14-year-old Dutch students. *Public Health Nutrition*, *8*(08), 1258-1265.

Martin, A., Normand, S., Sothier, M., Peyrat, J., Louche-Pelissier, C., & Laville, M. (2000). Is advice for breakfast consumption justified? Results from a short-term dietary and metabolic experiment in young healthy men. *British Journal of Nutrition*, *84*(03), 337-344.

McCaffrey, T. A., Rennie, K. L., Kerr, M. A., Wallace, J. M., Hannon-Fletcher, M. P., Coward, W. A., ... & Livingstone, M. B. E. (2008). Energy density of the diet and change in body fatness from childhood to adolescence; is there a relation? *The American Journal of Clinical Nutrition*, *87*(5), 1230-1237.

Moore, L. V., & Thompson, F. E. (2015). Adults meeting fruit and vegetable intake recommendations- United States, 2013. *Morbidity and Mortality Weekly Report*, *64*(26), 709-13.

Murakami, K., Miyake, Y., Sasaki, S., Tanaka, K., & Arakawa, M. (2012). An energy-dense diet is cross-sectionally associated with an increased risk of overweight in male children, but not in female children, male adolescents, or female adolescents in Japan: the Ryukyus Child Health Study. *Nutrition Research*, *32*(7), 486-494.

Murakami, K., Sasaki, S., Takahashi, Y., & Uenishi, K. (2007). Dietary energy density is associated with body mass index and waist circumference, but not with other metabolic risk factors, in free-living young Japanese women. *Nutrition*, *23*(11), 798-806.

Nelson, K. M., Weinsier, R. L., Long, C. L., & Schutz, Y. (1992). Prediction of resting energy expenditure from fat-free mass and fat mass. *The American Journal of Clinical Nutrition*, *56*(5), 848-856.

Neumark-Sztainer, D., French, S. A., Hannan, P. J., Story, M., & Fulkerson, J. A. (2005). School lunch and snacking patterns among high school students: associations with

school food environment and policies. *International Journal of Behavioral Nutrition and Physical Activity*, *2*(1), 14.

Neumark-Sztainer, D., Story, M., French, S. A., Hannan, P. J., Resnick, M. D., & Blum, R. W. (1997). Psychosocial concerns and health-compromising behaviors among overweight and non-overweight adolescents. *Obesity Research*, *5*(3), 237-249.

Neumark-Sztainer, D., Story, M., Falkner, N. H., Beuhring, T., & Resnick, M. D. (1999). Sociodemographic and personal characteristics of adolescents engaged in weight loss and weight/muscle gain behaviors: who is doing what? *Preventive Medicine*, *28*(1), 40-50.

Ng, S. W., & Popkin, B. M. (2012). Time use and physical activity: a shift away from movement across the globe. *Obesity Reviews*, *13*(8), 659-680.

Nicklas, T. A., Myers, L., Reger, C., Beech, B., & Berenson, G. S. (1998). Impact of breakfast consumption on nutritional adequacy of the diets of young adults in Bogalusa, Louisiana: ethnic and gender contrasts. *Journal of the American Dietetic Association*, *98*(12), 1432-1438.

Oldroyd, J. C., Unwin, N. C., White, M., Mathers, J. C., & Alberti, K. (2006). Randomised controlled trial evaluating lifestyle interventions in people with impaired glucose tolerance. *Diabetes Research and Clinical Practice*, *72*(2), 117-127.

Orozco, L. J. (2008). Exercise or exercise and diet for preventing type 2 diabetes mellitus. *Cochrane Database Of Systematic Reviews*, (3), doi:10.1002/14651858.CD003054.pub3

Ortega, F. B., Konstabel, K., Pasquali, E., Ruiz, J. R., Hurtig-Wennlöf, A., Mäestu, J., ... & Veidebaum, T. (2013). Objectively measured physical activity and sedentary time

during childhood, adolescence and young adulthood: a cohort study. *PLoS One*, *8*(4), e60871.

Pearson, D., & Grace, C. (2012). *Weight Management. [electronic resource]: A Practitioner's Guide*. Chichester, U.K.; Ames, Iowa : Wiley-Blackwell.

Pearson, N., & Biddle, S. J. (2011). Sedentary behavior and dietary intake in children, adolescents, and adults: a systematic review. *American Journal of Preventive Medicine*, *41*(2), 178-188.

Pendergast, F. J., Livingstone, K. M., Worsley, A., & McNaughton, S. A. (2016). Correlates of meal skipping in young adults: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, *13*(1), 125.

Pereira, M. A., Kartashov, A. I., Ebbeling, C. B., Van Horn, L., Slattery, M. L., Jacobs, D. R., & Ludwig, D. S. (2005). Fast-food habits, weight gain, and insulin resistance (the CARDIA study): 15-year prospective analysis. *The Lancet*, *365*(9453), 36-42.

Racette, S. B., Deusinger, S. S., Strube, M. J., Highstein, G. R., & Deusinger, R. H. (2008). Changes in weight and health behaviors from freshman through senior year of college. *Journal of Nutrition Education and Behavior*, *40*(1), 39-42.

Racette, S. B., Deusinger, S. S., Strube, M. J., Highstein, G. R., & Deusinger, R. H. (2005). Weight changes, exercise, and dietary patterns during freshman and sophomore years of college. *Journal of American College Health*, *53*(6), 245-251.

Rashidi, A., Mohammadpour-Ahranjani, B., Karandish, M., Vafa, M. R., Hajifaraji, M., Ansari, F., ... & Akhavi-Rad, M. B. (2007). Obese and female adolescents skip breakfast more than their non-obese and male peers. *Central European Journal of Medicine*, *2*(4), 481-487.

Richter, A., Heidemann, C., Schulze, M. B., Roosen, J., Thiele, S., & Mensink, G. B. (2012). Dietary patterns of adolescents in Germany-Associations with nutrient intake and other health related lifestyle characteristics. *BMC Pediatrics*, *12*(1), 35.

Rosenheck, R. (2008). Fast food consumption and increased caloric intake: a systematic review of a trajectory towards weight gain and obesity risk. *Obesity Reviews*, *9*(6), 535-547.

Rouhani, M. H., Haghighatdoost, F., Surkan, P. J., & Azadbakht, L. (2016). Associations between dietary energy density and obesity: A systematic review and meta-analysis of observational studies. *Nutrition*, *32*(10), 1037-1047.

Şanlıer, N. (2005). Gençlerde biyokimyasal bulgular, antropometrik ölçümler, vücut bileşimi, beslenme ve fiziksel aktivite durumlarının değerlendirilmesi. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi*, *25*(3), 47-73.

Seidell, J. C. (1998). Dietary fat and obesity: an epidemiologic perspective. *The American Journal of Clinical Nutrition*, *67*(3), 546S-550S.

Shaw, K., Gennat, H., O'Rourke, P., & Del Mar, C. (2006). Exercise for overweight or obesity. *Cochrane Database of Systematic Reviews*, (4), doi: 10.1002/14651858.CD003817.pub3.

Skender, M. L., Goodrick, G. K., Del Junco, D. J., Reeves, R. S., Darnell, L., GOTTO, A. M., & Foreyt, J. P. (1996). Comparison of 2-year weight loss trends in behavioral treatments of obesity: diet, exercise, and combination interventions. *Journal of the American Dietetic Association*, *96*(4), 342-346.

Smith, J. M., & Ditschun, T. L. (2009). Controlling satiety: how environmental factors influence food intake. *Trends in Food Science & Technology*, *20*(6), 271-277.

Song, W. O., Chun, O. K., Obayashi, S., Cho, S., & Chung, C. E. (2005). Is consumption of breakfast associated with body mass index in US adults? *Journal of the American Dietetic Association*, *105*(9), 1373-1382.

Story, M., Neumark-Sztainer, D., & French, S. (2002). Individual and environmental influences on adolescent eating behaviors. *Journal of the American Dietetic Association*, *102*(3), S40-S51.

Van Mechelen, W., Twisk, J., Post, G., Snel, J., & Kemper, H. (2000). Physical activity of young people: the Amsterdam Longitudinal Growth and Health Study. *Medicine and Science in Sports and Exercise*, *32*(9), 1610-1616.

Veerman, J. L., Barendregt, J. J., Beeck, E. F., Seidell, J. C., & Mackenbach, J. P. (2007). Stemming the obesity epidemic: a tantalizing prospect. *Obesity*, *15*(9), 2365-2370.

Webb, G. P. (2008). *Nutrition: A Health Promotion Approach* (3rd ed.). London: Hodder Arnold.

Webb, G. P. (2012). *Nutrition: Maintaining and Improving Health* (4th ed.). London: Hodder Arnold.

Wijndaele, K., Healy, G. N., Dunstan, D. W., Barnett, A. G., Salmon, J., Shaw, J. E., ... & Owen, N. (2010). Increased cardio-metabolic risk is associated with increased TV viewing time. *Medicine & Science in Sports & Exercise*, *42*(8), 1511-1518.

Williams, D. M., Dunsiger, S., Jennings, E. G., & Marcus, B. H. (2012). Does affective valence during and immediately following a 10-min walk predict concurrent and future physical activity? *Annals of Behavioral Medicine*, *44*(1), 43-51.

Williams, P. T., Krauss, R. M., Stefanick, M. L., Vranizan, K. M., & Wood, P. D. (1994). Effects of low-fat diet, calorie restriction, and running on lipoprotein subfraction concentrations in moderately overweight men. *Metabolism*, *43*(5), 655-663.

Wing, R. R., Venditti, E., Jakicic, J. M., Polley, B. A., & Lang, W. (1998). Lifestyle intervention in overweight individuals with a family history of diabetes. *Diabetes Care*, *21*(3), 350-359.

World Health Organization. (2015). *Obesity and overweight* (Fact sheet No. 311). Retrieved from http://www.who.int/mediacentre/factsheets/fs311/en/.

Wu, T., Gao, X., Chen, M., & Van Dam, R. M. (2009). Long-term effectiveness of diet-plus-exercise interventions vs. diet-only interventions for weight loss: a meta-analysis. *Obesity Reviews*, *10*(3), 313-323.

Wyatt, H. R., Grunwald, G. K., Mosca, C. L., Klem, M. L., Wing, R. R., & Hill, J. O. (2002). Long-term weight loss and breakfast in subjects in the National Weight Control Registry. *Obesity Research*, *10*(2), 78-82.

Yurttagül, M. (1995). Hafif Şişman ve Şişman Kadınların Beslenme Alışkanlıkları ve Zayıflamaya İlişkin Davranışları. *Beslenme ve Diyet Dergisi*, *24*(1), 59-73.

RESEARCH PROJECT REPORT

THE RELATIONSHIP BETWEEN NUTRITION BEHAVIOUR AND PHYSICAL ACTIVITY LEVELS ON BODY MASS INDEX IN STUDENTS OF THE UNITED KINGDOM

Abstract

Objective: Adoption of an inactive lifestyle and inappropriate eating behaviour increases the risk of developing chronic illness in adulthood. This study was aimed at determining the relationship between the body mass index (BMI), a critical factor in determining obesity, of the students of the University of Chester in the United Kingdom with their nutrition behaviour/habits and physical activity levels.

Methods: Volunteers and randomly selected 377 students who are studying at the University of Chester were included in the study. Nutrition behaviour/habits, anthropometric measurements and physical activity levels of the participants were determined by a questionnaire.

Results: This study included 150 males (39.8%) and 227 females (60.2%) with a mean age of 22.3 ± 4.2 years. There was no significant relationship (p=.856) between the score of positive attention to diet (33.58 ± 5.92) and BMI levels (24.19 ± 4.59 kg/m^2) of the students. There was no significant relationship (p=.548) between weekly physical activity levels (3385.62 ± 3046.23 MET.min/wk) and BMI levels (24.19 ± 4.59 kg/m^2) of the students. There was a significant relationship (p=.003) a very low positive correlation (r= .155) between the score of positive attention to diet (33.58 ± 5.92) and weekly physical activity levels (3385.62 ± 3046.23 MET.min/wk) of the students.

Conclusion: It has been found that physical activity level correlates positively with positive attention to diet. However; positive attention to diet and physical activity levels may not solely effective factors on the body mass index. There might be some other factors affecting body mass index. More research is needed to assess the relationship between BMI and other factors which contribute to obesity.

Key words: Body mass index (BMI), physical activity, nutrition behaviour, relationship

Introduction

Physical activity and dietary behaviour are actions that impact on health and well-being and the maintenance of a healthy weight. These routines comprise the basis for risk of lifestyle-related non-communicable diseases (Abu-Moghli, Khalaf & Barghoti, 2010). Calorie intake and physical activity frequency and intensity are the main determinants of energy balance. However, both weight loss and maintenance of healthy weight are obtained through a wide range of healthy nutrition (e.g., increased fruit/vegetable intake) and appropriate physical activity (e.g., reduced sedentary time) behaviours (Heerman et al., 2017).

The college years correspond to a period when students are increasingly making independent choices about lifestyle and health practices (El Ansari et al., 2011). However, the period also includes stresses for students who are trying to achieve success in their academic goals, despite financial constraints (El Ansari & Stock, 2010). These stress factors, in combination with experiences of 'freedom' from parental restrictions, may create the development of risky lifestyles, such as high alcohol and drug consumption and unhealthy nutrition behaviour (El Ansari et al., 2011). Unhealthy nutrition behaviours such as skipping meals, snacking, drinking sweetened beverages, and eating fast food are frequently examined as potential contributors to obesity (Pereira et al., 2005; Barnes, French, Mitchell & Wolfson, 2016). Dietary intake patterns that are consistent with the national dietary guidelines are associated with declined risk of developing chronic disease; but research indicates that students who are studying in higher education do not obey these guidelines (Plotnikoff et al., 2015). Students from the UK do not consume daily recommended fruit and vegetable consumption (88.7% and 83.5%, respectively) (El Ansari et al., 2011). Health promoting dietary and lifestyle changes at the population level in the United Kingdom (UK) could significantly reduce the overall cost of diet-related disease, which was found to be £5.8 billion in 2006–2007 (Scarborough et al., 2011). Going to university for the majority of UK students is a time when

individuals are primarily responsible for their dietary behaviours (Beasley, Hackett & Maxwell, 2004). Adopting healthy nutritional practices during this transition period can last into adulthood and thus reduce the risk of chronic diseases later in life (Steptoe et al., 2002).

According to data from the US 2003-2004 National Health and Nutrition Examination Survey (NHANES), there is observed a dramatic decline in physical activity between childhood and adolescence and the decline continues with age. Particularly, the prevalence of reaching physical activity recommendations declines rapidly between 18 and 24 years of age (Grim, Hortz & Petosa, 2011). As a consequence, in the United Kingdom, 73% of male and 79% of female university students do not follow physical activity guidelines (Haase, Steptoe, Sallis & Wardle, 2004). The effect of education can be reduced physical activity (Pengpid et al., 2015). Furthermore, it is discovered that adherence to the recommendation to get 150 minutes per week of physical activity is less than 5% among adults (Troiano et al., 2008). Low physical activity levels are associated with risk of obesity and cardiovascular disease (Sacheck, Kuder & Economos, 2010).

Given the lack of physical activity and healthy nutrition, it is not surprising that the prevalence of overweight/obesity in young adults has reached epidemic proportions. Recently, many studies suggest that lifestyle changes in adolescents and young adults are necessary because of the increasing tendency of various adverse health outcomes not otherwise typical for their age, including hypertension, dyslipidemia and metabolic syndromes which are linked to by obesity (Anthony, George & Eaton, 2014; Baysal et al., 2011). Proper dietary behaviour and adequate physical activity reduce the risk of chronic diseases (Chapman et al., 2014).

Late puberty and early adulthood seem to be important transitional periods that emphasise understanding of factors such as attitudes and knowledge towards health benefits, as they may be related to physical activity levels, nutritional behaviour and obesity prevalence

(Nelson, Kocos, Lytle & Perry, 2009). This study was aimed at determining the relationship between the body mass index (BMI), a critical factor in determining obesity, of the students of the University of Chester in the United Kingdom with their nutrition behaviours/habits and physical activity levels.

1. Methods

1.1. Population and sample

The cross-sectional study was conducted at the University of Chester in the 2016-2017 academic year. Students who are studying at the University of Chester were included in the study. Approval was obtained from the Research Ethics Committee of the Faculty of Medicine, Dentistry and Life Sciences at the University of Chester regarding the conduct of the research. Each participant included in the survey was informed about the research by a participant information sheet. Students were asked whether they would participate in the survey. The sample size representing the population was calculated as 377, and it was aimed to include volunteers who were randomly selected among all the students and studying at different campuses of the University (Krejcie & Morgan, 1970). A total of 377 (150 males and 227 females) students from different campuses of the University of Chester were reached, and a questionnaire was conducted with a one-to-one interview with volunteer students selected randomly.

1.2. Questionnaire

Physical activity levels and eating habits of the participants were assessed by a questionnaire consisting of two parts, totalling 27 questions. In the first part of the questionnaire, socio-demographic characteristics, anthropometric estimates and eating habits/behaviours of the participants were recorded, and in the second part, physical activity levels of the participants were recorded using the International Physical Activity Questionnaire

(IPAQ-short form) which can collect reliable and valid physical activity data (Craig et al., 2003).

Meal patterns, belief about weight, behaviour about weight and positive attention to diet of the participants were evaluated in the questionnaire (see Appendix 2). Positive attention to diet of the participants was calculated by scoring the answers on the questionnaire. In order to identify positive attention to diet, it was determined positive or negative food markers. The positive food markers included foods that young people are usually advised to eat more of (i.e. low-fat, low sugar, adequate water consumption, high-fibre foods), and the negative markers included foods which young people are recommended to limit their intake of (i.e. high-fat, sugary, salty, low fibre foods). The number of positive and negative marker foods consumed by each respondent was then calculated. Positive attention to diet was calculated as 3 points, moderate attention to diet was calculated as 2 points, and non-positive attention to diet was calculated as 1 point. The scores obtained were collected and recorded. The body mass index (BMI) was calculated according to the self-reported height and weight estimated information from the participants (Gandy, 2013).

The International Physical Activity Questionnaire consists of seven questions and provides information of the time spent on the sitting, walking, moderate activities and vigorous activities of the participants' last seven days (see Appendix 2). In the evaluation of all activities, it has been taken as a criterion that each activity is performed at least 10 minutes at a time. Weekly physical activity was computed by multiplying time (minutes of given activity in the reported week) by intensity (in MET units) corresponding to that activity: 8, 4 or 3.3 MET for intense, moderate and walking activities, respectively (Biernat, Stupnicki, Lebiedziński & Janczewska, 2008).

1.3. Statistical analysis

The analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 23.0 (SPSS Inc., Chicago, Illinois, USA). The level of significance was established in a two-tailed *P*-value <.05. Descriptive statistics were used for continuous variables and percentages and frequency distributions for categorical variables. Since the number of samples is over 100, the normal distribution of variables was determined by the Kolmogorov-Smirnov test (Coakes & Steed, 2007). Six questionnaires having multiple blank cells have handled as missing values in SPSS to obtain healthy data (Pallant, 2010).

The relationship between positive attention to diet and BMI; weekly physical activity levels and BMI; positive attention to diet and weekly physical activity levels; age and positive attention to diet; age and weekly physical activity levels; level of study and positive attention to diet; level of study and weekly physical activity levels were assessed by the Spearman's Rho correlation coefficient. Mann Whitney U tests were performed to determine significant interactions of age and positive attention to diet as the dependent variables; age and weekly physical activity levels as the dependent variables; sex and weekly physical activity levels as the dependent variables; sex and positive attention to diet as the dependent variables; sex and weight perception of the participants as the dependent variables; sex and the frequency of diets applied in the six months as the dependent variables. Independent t-test was performed to determine significant interactions of sex and positive attention to diet. Kruskal Wallis test was conducted to determine the differences between positive attention to diet and ethnicity; weekly physical activity levels and ethnicity; positive attention to diet and snacking behaviour; snacking behaviour and body mass index.

2. Results

This study included 150 males (39.8%) and 227 females (60.2%) with a mean age of 22.3 ± 4.2 years. There were students who are pursuing level 6 (final year) (63.7%), master's degree (14.3%), level 4 (first year) (10.4%), level 5 (second year) (9.5%), research degree (1.6 %) in the research. Of the participants in this study; 83 % were White, 4.8% were Black or African, 7.7% were Asian, 4.2 % were "other". The mean of the BMI level of the participants was 24.2 ± 0.2 kg/m^2. The average BMI was 24.7 ± 0.4 kg/m^2 in male, and 23.84 ± 0.3 kg/m^2 in female. Socio-demographic characteristics of the participants were indicated on Table-1.

Table-1 Key characteristics of the participants

Socio-demographic characteristics		**N**	**(%)**
Gender	Male	150	39.8
	Female	227	60.2
Age	18 to 30 years	361	95.8
	30 to 50 years	16	4.2
Ethnic	White	313	83
	Black or African	18	4.8
	Asian	29	7.7
	Other	16	4.2
Level of study	Level 4 (first year)	41	10.9
	Level 5 (second year)	36	9.5
	Level 6 (final year)	240	63.7
	Master's degree	54	14.3
	Research degree	6	1.6

In this study, it is discovered that 59% of the participants consumed snacks instead of a regular meal sometimes. 67% of the participants who had a body mass index above 30 (obese) want to lose more than 5 kilogrammes. Also, half of obese participants were skipping meals. It is found that 55.9% of the obese group was watching television while eating in sometimes;

29.4% of the obese group was watching television while eating all times. The average BMI was determined from self-reports to be 24.7 ± 0.4 kg/m^2 in male, and 23.84 ± 0.3 kg/m^2 in female. When participants were asked about their own weight, 34% of the participants responded they wanted to lose at least five kilograms. 24.9% of the participants responded the same question between 1 and 4 kilograms. It is discovered that 40% of female participants; 20% of male participants want to lose at least 5 kilogrammes or more weight (see Table-2). In this study, it has been found that the vast majority of obese participants (67.7%) applied a diet at least once during the past six months. 35.3% of obese participants had applied diet once; 32.4% of obese participants had applied diets 2-3 times in the past six months. It has been discovered that the vast majority of obese participants do not resort to methods other than diet to lose weight in the past six months. The majority of obese participants (88.2%) had never attempted to use diet pills and laxative to lose weight in the past six months. 91.2% of obese participants had never made themselves vomit as a way to lose weight in the past six months. Although there was no significant difference between gender and BMI (p=.069), it is found that there was a significant difference between gender and weight perception of the participant (p=.0001). Furthermore, it is discovered the female students applied significantly more diets (at least once) than the male students (never) in the past six months (p=.0001) (see Table-3). It was found male students to be significantly (p=.002) more physically active than females in this study.

Table-2 Distribution of questions to determine weight perception according to sex

			Sex		Total
			Male	**Female**	
Perceived weight	Would like to lose at least 5 kilogrammes	Count	33	95	128
		% within sex	22.0%	41.9%	34.0%
	Would like to lose 1-4 kilogrammes	Count	24	70	94
		% within sex	16.0%	30.8%	24.9%
	My weight is about right	Count	52	55	107
		% within sex	34.7%	24.2%	28.4%
	Would like to gain 1-4 kilogrammes	Count	23	4	27
		% within sex	15.3%	1.8%	7.2%
	Would like to gain at least 5 kilogrammes	Count	18	3	21
		% within sex	12.0%	1.3%	5.6%
Total		Count	150	227	377
		% within sex	100%	100%	100%

Table-3 Distribution of the frequency of diet applied in the past six months according to sex

			Sex		Total
			Male	**Female**	
In the past six months, The frequency of diets applied	Never	Count	92	85	177
		% within sex	61.3%	37.4%	46.9%
	Once	Count	35	58	93
		% within sex	23.3%	25.6%	24.7%
	2-3 times	Count	12	59	71
		% within sex	8.0%	26.0%	18.8%
	4 or more times	Count	11	25	36
		% within sex	7.3%	11.0%	9.5%
Total		Count	150	227	377
		% within sex	100%	100%	100%

Table-4 The results of all statistical analysis

Correlation		
Independent Variable	**Dependent Variable**	**Outcomes**
The score of positive attention to diet	BMI	p= .856 r= -.009
Weekly physical activity levels	BMI	p= .548 r= .031
Weekly physical activity levels	The score of positive attention to diet	**p= .003** r=.155
Age	The score of positive attention to diet	**p= .0001** r=.229
Age	Weekly physical activity levels	p= .732 r= .018
Level of study	The score of positive attention to diet	**p= .008** r= .136
Level of study	Weekly physical activity levels	p= .934 r= -.004
Differences		
Independent Variable	**Dependent Variable**	
Gender	The frequency of diet applied in the past six months	**p= .0001**
Gender	BMI	p= .069
Gender	Weight perception of the participants	**p= .0001**
Age classification (between 18 to 30 years and 31 to 50 years)	The score of positive attention to diet	**p= .011**
Gender	The score of positive attention to diet	p= .727
Gender	Weekly physical activity levels	**p= .002**
Ethnic groups	The score of positive attention to diet	p= .055
Ethnic groups	Weekly physical activity levels	p= .074
Consuming snacks instead of regular meals	BMI	p= .082
The score of positive attention to diet	Consuming snacks instead of regular meals	**p= .0001**

(Significance at $p \leq .05$ in bold)

There was no significant relationship (p=.856) between the score of positive attention to diet (33.58 ± 5.92) and BMI levels (24.19 ± 4.59 kg/m^2) of the students. There was no significant relationship (p=.548) between weekly physical activity levels (3385.62 ± 3046.23 MET.min/wk) and BMI levels (24.19 ± 4.59 kg/m^2) of the students. There was a significant relationship (p=.003) a very low positive correlation (r= .155) between the score of positive attention to diet (33.58 ± 5.92) and weekly physical activity levels (3385.62 ± 3046.23 MET.min/wk) of the students.

There was a significant relationship (p=.0001) a low positive correlation (r= .229) between age (22.3 ± 4.2) and the score of positive attention to diet (33.58 ± 5.92) of the students. There was a significant difference (p=.011) between the score of positive attention to diet of the students who are between 18 to 30 years (33.40 ± 0.3) and the students who are between 31 to 50 years (37.56 ± 1.5). There was no significant relationship (p=.732) between age (22.3 ± 4.2) and weekly physical activity levels (3385.62 ± 3046.23 MET.min/wk) of the students. There was no significant difference (p=.727) between the score of positive attention to diet of male students (33.71 ± 5.81) and the score of positive attention to diet of female students (33.49 ± 6). It is found that weekly physical activity levels of the male students (3772.07 ± 232.32 MET.min/wk) is significantly higher (p=.002) the weekly physical activity levels of the female students (3130.25 ± 209.21 MET.min/wk).

There was no significant difference (p=.055) between ethnic groups with respect to the score of positive attention to diet of the students. There was no significant difference (p=.074) between weekly physical activity levels of the students and the ethnic groups of the students. There was a significant relationship (p=.008) a very low positive correlation (r= .136) between the score of positive attention to diet for different levels of study of the students. There was no significant relationship (p=.934) between weekly physical activity levels and level of study of the students. There was no significant difference (p=.082) between snacking behaviour and

BMI. It is found that the score of positive attention to diet of participants who are not consuming snacks instead of regular meals (36.29 ± 5.04) is significantly higher (p=.0001) the score of positive attention to diet of the participants who are consuming snacks instead of regular meals sometimes (33.24 ± 5.46) and the score of positive attention to diet of the participants who are consuming snacks instead of regular meals most of times (27.70 ± 6.12).

3. Discussion

This study investigated anthropometric measurements, nutrition behaviour/habits and physical activity levels of the students of the University of Chester in the United Kingdom. The size and importance of this population which includes highly educated young adults are increasingly attracted by decision-makers, educators and public health policies. This study increases our knowledge of the effect of the nutritional habits and physical activity levels on body weight and health profile of these young adults. It also contributes to our understanding of the health promoting variables that contribute to the well-being of university students.

The lack of a relationship between physical activity levels and BMI is somehow unexpected. However, while a few studies indicated inverse associations (Dionne, Alméras, Bouchard & Tremblay, 2000; Pietiläinen et al., 2008) others did not find evidence of this relationship (Armstrong, Williams, Balding, Gentle & Kirby, 1991; Aires et al., 2010), especially when energy expenditure is adjusted for fat free mass (Goran, 1997). Similarly, there is no significant relationship between BMI and physical activity levels in this study. Participants' subjective evaluations of physical activity levels may have led to the rejection of the expected hypothesis. Students in this study estimated their time spent on walking, vigorous and moderate physical activities. Participants who indicated their time spent on walking may walk as speedily as a moderate intensity physical activity. However, the international physical

activity questionnaire does not ask the definition of walking speed; for this reason, the question on walking includes those who walk slowly, as well as those who walk fast.

In this study, there is no relationship between positive attention to diet and BMI. This may be due to the fact that the daily energy intake of the participants is not taken into account when determining a positive attention to diet of the participants. In a cross-sectional study which examined the relationship between dietary energy density and levels of BMI are found a significant relationship between BMI and dietary energy density (Mendoza, Drewnowski & Christakis, 2007). On the other hand, in a study (n= 1631) by Ambrossini et al. (2009), the diet patterns of the subjects were divided into "healthy" pattern which included high intakes of whole grains, fruit, vegetables, legumes and fish, and "Western" pattern, consist of intakes of take-away foods, soft drinks, confectionery, French fries, refined grains, full-fat dairy products and processed meats and no significant difference was found between two diet patterns and BMI.

Determining only the level of physical activity and eating habits of the individuals may not be sufficient to comment on the effects of them on BMI levels. The research of Wright and Aronne (2012) illustrates that the dramatic increase in the incidence of obesity in many countries is due to a variety of factors including genetic, physiological, environmental, psychological, social, economic, and political.

It was determined in this study that; there was a significant relationship (p=.003) a positive correlation (r= .155) between the level of physical activity and the positive attention to diet. It is discovered that when the physical activity level of participants has decreased, positive attention to diet has decreased. Therefore, sedentary individuals may consume more energy dense foods and may not prefer to eat healthy foods. Another longitudinal study was conducted to assess the relationship between sedentary behaviour and dietary intake in adults.

This study indicated that as sedentary behaviour the television viewing was positively associated with energy-dense snack consumption (Panagiotakos et al., 2008). There are many longitudinal studies assessing the relationship between sedentary behaviour and dietary intake in adolescents, and the studies indicated that sedentary behaviour was inversely associated with fruit and vegetable consumption (Larson et al., 2009; Larson et al., 2008) and positively associated with energy-dense drinks (Barr-Anderson, Larson, Nelson, Neumark-Sztainer & Story, 2009). Overall, sedentary behaviour in adolescents seems to be associated with unhealthy diet pattern. A systematic review which includes fifty-three observational studies assessing an association between at least one sedentary behaviour and at least one aspect of dietary intake in children (aged <11 years), adolescents (aged 12–18 years), or adults (aged >18 years) indicated that sedentary behaviour, usually assessed as screen time and predominantly television viewing, is related with unhealthy dietary behaviours in children, adolescents, and adults (Pearson & Biddle, 2011). Watching television indicates that people have broken the ability to accurately predict food consumption during viewing, which may lead to unintentional consumption of foods. Additionally, it is thought that it may contribute to overweight and obesity in combination with eating and sedentary activity of watching television (Moray, Fu, Brill & Mayoral, 2007). It is discovered that majority of the obese participants (85.3%) were either always or sometimes watching TV while eating. This result is consistent with other studies showing that watching television adversely affects the ability of individuals to predict food intake correctly (Moray et al., 2007).

It is a difficult job to maintain the new weight after losing weight. Along with this, an initially successful weight loss is in some cases resulted not only by a return to the pre-diet weight but also by further weight regain. This “yo-yo-like” trend in body weight has been defined as weight cycling (Cereda et al., 2016). In this study, it has been found that the vast

majority of the obese participants (67.7%) applied a diet at least once during the past six months. These results suggest that the obese participants may be weight cycling.

It is observed in this cross-sectional research that snack consumption instead of regular meals is a risk factor for negative attention to diet. However, it is discovered that the snack consumption instead of regular meals does not contribute to BMI in UK young adults. Various studies have shown that frequent snacking is associated with high total caloric intake (Sebastian, Cleveland & Goldman, 2008; Keast, Nicklas & O'neil, 2010). On the other hand, most previous research has found no evidence that there is a relationship between snack behaviour and weight status (Larson & Story, 2013). More detailed studies are needed to fully understand all aspects of how the relationship between snacking behaviour and weight outcomes depends on the nutritional composition and portions of food.

Although there is no significant sex difference between BMI levels; it has been discovered that perception of body weight varies according to sex. Female students are more likely to try to lose weight and to apply more diets than male students. This can be explained as the media effect, which shows thin figures as ideal for females. Similarly, in a study investigating the differences between body perception between sex, it was determined that females were generally more concerned about their body weight, body shape, and eating than males, and therefore applied diet and weight loss strategies more often (Kuan, Ho, Shuhaili, Siti & Gudum, 2011). In 2007, Cheung, Ip, Lam and Bibby showed that the weight control behaviours of females are more evident than males. They also indicated that more females than males considered themselves to be overweight and more males than females considered themselves to be underweight. Moreover, like other studies (El-Gilany, Badawi, El-Khawaga & Awadalla, 2011; Quick et al., 2016) it was found male students to be significantly ($p=.002$) more physically active than females in this study. Males' tendency to not try to lose weight and a more active lifestyle may have been the resulting desire to better-built and muscular body.

However; the desire to choose an ideal body shape that is well built and muscular may influence males to have negative perceptions towards their body shape (Patricia & Arnold, 2002).

3.1. Limitations

The fact that students participating in the study did not assess the barriers to nutrition and physical activity was considered as a limitation of the study. Because of this deficiency, the factors that make a difference in the participation of physical activity and positive attention to diet among the students were not revealed. It was used a questionnaire with several sensitive questions. Additional studies that use more objective measures (e.g., accelerometers, scale, height gauge) to determine the physical activity levels and BMI levels of students are recommended. The certain factors might have influenced the findings of the present study, such as the potential bias in the process of recalling and recording physical activity and nutrition behaviours.

Conclusion

It has been found that physical activity level correlates positively with positive attention to diet. However; positive attention to diet and physical activity levels may not solely effective factors on the body mass index. There might be some other factors affecting body mass index. More research is needed to assess the relationship between BMI and other factors which contribute to obesity.

REFERENCES

Abu-Moghli, F. A., Khalaf, I. A., & Barghoti, F. F. (2010). The influence of a health education programme on healthy lifestyles and practices among university students. *International Journal of Nursing Practice*, *16*(1), 35-42.

Aires, L., Silva, P., Silva, G., Santos, M. P., Ribeiro, J. C., & Mota, J. (2010). Intensity of physical activity, cardiorespiratory fitness, and body mass index in youth. *Journal of Physical Activity and Health*, *7*(1), 54-59.

Ambrosini, G. L., Oddy, W. H., Robinson, M., O'Sullivan, T. A., Hands, B. P., De Klerk, N. H., ... & Beilin, L. J. (2009). Adolescent dietary patterns are associated with lifestyle and family psycho-social factors. *Public Health Nutrition*, *12*(10), 1807-1815.

Anthony, D., George, P., & Eaton, C. B. (2014). Cardiac risk factors: new cholesterol and blood pressure management guidelines. *FP Essentials*, *421*, 28-43.

Armstrong, N., Williams, J., Balding, J., Gentle, P., & Kirby, B. (1991). Cardiopulmonary fitness, physical activity patterns, and selected coronary risk factor variables in 11-to 16-year-olds. *Pediatric Exercise Science*, *3*(3), 219-228.

Barnes, T. L., French, S. A., Mitchell, N. R., & Wolfson, J. (2016). Fast-food consumption, diet quality and body weight: cross-sectional and prospective associations in a community sample of working adults. *Public Health Nutrition*, *19*(5), 885-892.

Barr-Anderson, D. J., Larson, N. I., Nelson, M. C., Neumark-Sztainer, D., & Story, M. (2009). Does television viewing predict dietary intake five years later in high school students and young adults? *International Journal of Behavioral Nutrition and Physical Activity*, *6*(1), 7.

Baysal, A., Aksoy, M., Besler, H. T., Bozkurt, N., Keçecioğlu, S., Mercanlıgil, S. M., ... & Yıldız, E. (2011). *Diyet El Kitabı.* (6th ed.). Ankara: Hatipoğlu Yayınevi.

Beasley, L. J., Hackett, A. F., & Maxwell, S. M. (2004). The dietary and health behaviour of young people aged 18–25 years living independently or in the family home in Liverpool, UK. *International Journal of Consumer Studies*, *28*(4), 355-363.

Biernat, E., Stupnicki, R., Lebiedziński, B., & Janczewska, L. (2008). Assessment of physical activity by applying IPAQ questionnaire. *Physical Education and Sport*, *52*(2), 83-89.

Cereda, E., Malavazos, A. E., Caccialanza, R., Rondanelli, M., Fatati, G., & Barichella, M. (2011). Weight cycling is associated with body weight excess and abdominal fat accumulation: a cross-sectional study. *Clinical Nutrition*, *30*(6), 718-723.

Chapman, C. D., Nilsson, V. C., Thune, H. Å., Cedernaes, J., Le Grevès, M., Hogenkamp, P. S., ... & Schiöth, H. B. (2014). Watching TV and food intake: the role of content. *PLoS One*, *9*(7), e100602.

Cheung, P. C., Ip, P. L., Lam, S. T., & Bibby, H. (2007). A study on body weight perception and weight control behaviours among adolescents in Hong Kong. *Hong Kong Medical Journal*, *13*(1), 16.

Coakes, S. J., & Steed, L. G. (2007). *SPSS Version 14.0 for Windows: Analysis without Anguish*. Milton, Qld.: John Wiley & Sons Australia.

Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., ... & Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine & Science in Sports & Exercise*, *35*(8), 1381-1395.

Dionne, I., Alméras, N., Bouchard, C., & Tremblay, (2000). The association between vigorous physical activities and fat deposition in male adolescents. *Medicine and Science in Sports and Exercise*, *32*(2), 392-395.

El Ansari, W., & Stock, C. (2010). Is the health and wellbeing of university students associated with their academic performance? Cross sectional findings from the United Kingdom. *International Journal of Environmental Research and Public Health*, *7*(2), 509-527.

El Ansari, W., Stock, C., John, J., Deeny, P., Phillips, C., Snelgrove, S., ... & Mabhala, A. (2011). Health promoting behaviours and lifestyle characteristics of students at seven universities in the UK. *Central European Journal of Public Health*, *19*(4), 197.

El-Gilany, A. H., Badawi, K., El-Khawaga, G., & Awadalla, N. (2011). Physical activity profile of students in Mansoura University, Egypt/Profil de l'activité physique des étudiants de l'Université de Mansoura (Égypte). *Eastern Mediterranean Health Journal*, *17*(8), 694.

Gandy, J. (2013). *Manual of Dietetic Practice* (5th ed.). Chichester: Wiley-Blackwell.

Goran, M. I. (1997). Energy expenditure, body composition, and disease risk in children and adolescents. *Proceedings of the Nutrition Society*, *56*(1B), 195-209.

Grim, M., Hortz, B., & Petosa, R. (2011). Impact evaluation of a pilot web-based intervention to increase physical activity. *American Journal of Health Promotion*, *25*(4), 227-230.

Haase, A., Steptoe, A., Sallis, J. F., & Wardle, J. (2004). Leisure-time physical activity in university students from 23 countries: associations with health beliefs, risk awareness, and national economic development. *Preventive Medicine*, *39*(1), 182-190.

Heerman, W. J., Jackson, N., Hargreaves, M., Mulvaney, S. A., Schlundt, D., Wallston, K. A., & Rothman, R. L. (2017). Clusters of healthy and unhealthy eating behaviors are associated with body mass index among adults. *Journal of Nutrition Education and Behavior*, *49*(5), 415-421.

Keast, D. R., Nicklas, T. A., & O'neil, C. E. (2010). Snacking is associated with reduced risk of overweight and reduced abdominal obesity in adolescents: National Health and Nutrition Examination Survey (NHANES) 1999–2004. *The American Journal of Clinical Nutrition*, *92*(2), 428-435.

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, *30*(3), 607-610.

Kuan, P. X., Ho, H. L., Shuhaili, M. S., Siti, A. A., & Gudum, H. R. (2011). Gender differences in body mass index, body weight perception and weight loss strategies among undergraduates in Universiti Malaysia Sarawak. *Malaysian Journal of Nutrition*, *17*(1).

Larson, N. I., Neumark-Sztainer, D. R., Harnack, L. J., Wall, M. M., Story, M. T., & Eisenberg, M. E. (2008). Fruit and vegetable intake correlates during the transition to young adulthood. *American Journal of Preventive Medicine*, *35*(1), 33-37.

Larson, N. I., Neumark-Sztainer, D., Harnack, L., Wall, M., Story, M., & Eisenberg, M. E. (2009). Calcium and dairy intake: longitudinal trends during the transition to young adulthood and correlates of calcium intake. *Journal of Nutrition Education and Behavior*, *41*(4), 254-260.

Larson, N., & Story, M. (2013). A review of snacking patterns among children and adolescents: what are the implications of snacking for weight status? *Childhood Obesity*, *9*(2), 104-115.

Mendoza, J. A., Drewnowski, A., & Christakis, D. A. (2007). Dietary energy density is associated with obesity and the metabolic syndrome in US adults. *Diabetes Care*, *30*(4), 974-979.

Moray, J., Fu, A., Brill, K., & Mayoral, M. S. (2007). Viewing television while eating impairs the ability to accurately estimate total amount of food consumed. *Bariatric Nursing and Surgical Patient Care, 2*(1), 71-76.

Nelson, M. C., Kocos, R., Lytle, L. A., & Perry, C. L. (2009). Understanding the perceived determinants of weight-related behaviors in late adolescence: a qualitative analysis among college youth. *Journal of Nutrition Education and Behavior, 41*(4), 287-292.

Pallant, J. (2010). *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS* (4th ed.). Maidenhead: Open University Press.

Panagiotakos, D. B., Pitsavos, C., Lentzas, Y., Skoumas, Y., Papadimitriou, L., Zeimbekis, A., & Stefanadis, C. (2008). Determinants of physical inactivity among men and women from Greece: a 5-year follow-up of the ATTICA study. *Annals of Epidemiology*, *18*(5), 387-394.

Patricia W.C. & Arnold E.A. (2002). Body image issues among boys and men. Thomas F.C. & Thomas P. (Eds). *In: Body Image: A Handbook of Theory, Research and Clinical Practice*. (pp. 183-191). New York, United States: The Guilford Press.

Pearson, N., & Biddle, S. J. (2011). Sedentary behavior and dietary intake in children, adolescents, and adults: a systematic review. *American Journal of Preventive Medicine*, *41*(2), 178-188.

Pengpid, S., Peltzer, K., Kassean, H. K., Tsala, J. P. T., Sychareun, V., & Müller-Riemenschneider, F. (2015). Physical inactivity and associated factors among

university students in 23 low-, middle-and high-income countries. *International Journal of Public Health*, *60*(5), 539-549.

Pereira, M. A., Kartashov, A. I., Ebbeling, C. B., Van Horn, L., Slattery, M. L., Jacobs, D. R., & Ludwig, D. S. (2005). Fast-food habits, weight gain, and insulin resistance (the CARDIA study): 15-year prospective analysis. *The Lancet*, *365*(9453), 36-42.

Pietiläinen, K. H., Kaprio, J., Borg, P., Plasqui, G., Yki-Järvinen, H., Kujala, U. M., ... & Rissanen, A. (2008). Physical inactivity and obesity: a vicious circle. *Obesity*, *16*(2), 409-414.

Plotnikoff, R. C., Costigan, S. A., Williams, R. L., Hutchesson, M. J., Kennedy, S. G., Robards, S. L., ... & Germov, J. (2015). Effectiveness of interventions targeting physical activity, nutrition and healthy weight for university and college students: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, *12*(1), 45.

Quick, V., Byrd-Bredbenner, C., Shoff, S., White, A. A., Lohse, B., Horacek, T., ... & Greene, G. (2016). A streamlined, enhanced self-report physical activity measure for young adults. *International Journal of Health Promotion and Education*, *54*(5), 245-254.

Sacheck, J. M., Kuder, J. F., & Economos, C. D. (2010). Physical fitness, adiposity, and metabolic risk factors in young college students. *Medicine and Science in Sports and Exercise*, *42*(6), 1039-1044.

Scarborough, P., Bhatnagar, P., Wickramasinghe, K. K., Allender, S., Foster, C., & Rayner, M. (2011). The economic burden of ill health due to diet, physical inactivity, smoking, alcohol and obesity in the UK: an update to 2006–07 NHS costs. *Journal of Public Health*, *33*(4), 527-535.

Sebastian, R. S., Cleveland, L. E., & Goldman, J. D. (2008). Effect of snacking frequency on adolescents' dietary intakes and meeting national recommendations. *Journal of Adolescent Health*, *42*(5), 503-511.

Steptoe, A., Wardle, J., Cui, W., Bellisle, F., Zotti, A. M., Baranyai, R., & Sanderman, R. (2002). Trends in smoking, diet, physical exercise, and attitudes toward health in European university students from 13 countries, 1990–2000. *Preventive Medicine*, *35*(2), 97-104.

Troiano, R. P., Berrigan, D., Dodd, K. W., Mâsse, L. C., Tilert, T., & McDowell, M. (2008). Physical activity in the United States measured by accelerometer. *Medicine and Science in Sports and Exercise*, *40*(1), 181.

Wright, S. M., & Aronne, L. J. (2012). Causes of obesity. *Abdominal Radiology*, *37*(5), 730-732.

APPENDICES

Appendix 1 SPSS outputs

Table- Test of normality of the score of positive attention to diet and BMI			
	Kolmogorov- Smirnov		
	Statistic	df	Sig.
The score of positive attention to diet	.063	371	.001
Body mass index	.107	371	.000

Table- Correlation between the score of positive attention to diet and BMI			
		The score of positive attention to diet	Body mass index
Spearman's rho The score of positive attention to diet	Correlation coefficient Sig (2- tailed) N	1.000 . 377	-.009 .856 371
Body mass index	Correlation coefficient Sig (2- tailed) N	-.009 .856 371	1.000 . 371

Table- Descriptive statistics of the score of positive attention to diet and BMI					
	N	Minimum	Maximum	Mean	Std. Deviation
The score of positive attention to diet	371	18	48	33.58	5.921
Body mass index	371	17.10	47.75	24.1964	4.59973
Valid N(listwise)	371				

Table- Descriptives of the score of positive attention to diet and BMI				
			Statistic	Std. Error
body mass index	Mean		24.1964	.23881
	95% Confidence Interval for Mean	Lower Bound	23.7268	
		Upper Bound	24.6660	
	5% Trimmed Mean		23.7931	
	Median		23.1405	
	Variance		21.158	
	Std. Deviation		4.59973	
	Minimum		17.10	
	Maximum		47.75	
	Range		30.65	
	Interquartile Range		5.28	
	Skewness		1.618	.127
	Kurtosis		4.068	.253
the score of positive attention to diet	Mean		33.61	.309
	95% Confidence Interval for Mean	Lower Bound	33.00	
		Upper Bound	34.21	
	5% Trimmed Mean		33.65	
	Median		34.00	
	Variance		35.342	
	Std. Deviation		5.945	
	Minimum		18	
	Maximum		48	
	Range		30	
	Interquartile Range		9	
	Skewness		-.152	.127
	Kurtosis		-.407	.253

Table- Test of normality of the score of international physical activity questionnaire and BMI			
	Kolmogorov- Smirnov		
	Statistic	df	Sig.
The score of international physical activity questionnaire	.135	371	.000
Body mass index	.107	371	.000

Table- Correlation between the score of international physical activity questionnaire and BMI			
		Body mass index	The score of international physical activity questionnaire
Spearman's rho Body mass index	Correlation coefficient Sig (2- tailed) N	1.000 . 377	.031 .548 371
The score of international physical activity questionnaire	Correlation coefficient Sig (2- tailed) N	.031 .548 371	1.000 . 371

Table- Descriptive statistics of the score of international physical activity questionnaire and BMI					
	N	Minimum	Maximum	Mean	Std. Deviation
The score of international physical activity questionnaire	371	0	17010	3385.62	3046.233
Body mass index	371	17.10	47.75	24.1964	4.59973
Valid N(listwise)	371				

Table- Descriptives of the score of international physical activity questionnaire and BMI				
			Statistic	Std. Error
body mass index	Mean		24.1964	.23881
	95% Confidence Interval for Mean	Lower Bound	23.7268	
		Upper Bound	24.6660	
	5% Trimmed Mean		23.7931	
	Median		23.1405	
	Variance		21.158	
	Std. Deviation		4.59973	
	Minimum		17.10	
	Maximum		47.75	
	Range		30.65	
	Interquartile Range		5.28	
	Skewness		1.618	.127
	Kurtosis		4.068	.253
the score of international physical activity questionnaire	Mean		3396.18	158.325
	95% Confidence Interval for Mean	Lower Bound	3084.85	
		Upper Bound	3707.51	
	5% Trimmed Mean		3106.49	
	Median		2544.00	
	Variance		9299747.002	
	Std. Deviation		3049.549	
	Minimum		0	
	Maximum		17010	
	Range		17010	
	Interquartile Range		3564	
	Skewness		1.407	.127
	Kurtosis		1.994	.253

Table- Test of normality of the score of international physical activity questionnaire and the score of positive attention to diet			
	Kolmogorov- Smirnov		
	Statistic	df	Sig.
The score of international physical activity questionnaire	.135	377	.000
The score of positive attention to diet	.062	377	.002

Table- Correlation between the score of positive attention to diet and the score of international physical activity questionnaire			
		The score of positive attention to diet	The score of international physical activity questionnaire
Spearman's rho The score of positive attention to diet	Correlation coefficient Sig (2- tailed) N	1.000 . 377	.155 .003 377
The score of international physical activity questionnaire	Correlation coefficient Sig (2- tailed) N	.155 .003 377	1.000 . 377

Table- Descriptive statistics of positive attention to diet and the score of international physical activity questionnaire					
	N	Minimum	Maximum	Mean	Std. Deviation
The score of international physical activity questionnaire	377	0	17010	3385.62	3046.233
The score of positive attention to diet	377	18	48	33.58	5.921
Valid N(listwise)	377				

Table- Descriptives of the score of positive attention to diet and the score of international physical activity questionnaire

			Statistic	Std. Error
the score of positive attention to diet	Mean		33.58	.305
	95% Confidence Interval for Mean	Lower Bound	32.98	
		Upper Bound	34.18	
	5% Trimmed Mean		33.62	
	Median		34.00	
	Variance		35.064	
	Std. Deviation		5.921	
	Minimum		18	
	Maximum		48	
	Range		30	
	Interquartile Range		9	
	Skewness		-.142	.126
	Kurtosis		-.402	.251
the score of international physical activity questionnaire	Mean		3385.62	156.889
	95% Confidence Interval for Mean	Lower Bound	3077.13	
		Upper Bound	3694.11	
	5% Trimmed Mean		3096.61	
	Median		2514.00	
	Variance		9279538.434	
	Std. Deviation		3046.233	
	Minimum		0	
	Maximum		17010	
	Range		17010	
	Interquartile Range		3588	
	Skewness		1.402	.126
	Kurtosis		1.974	.251

Table- Correlation between the score of positive attention to diet and age			
		The score of positive attention to diet	Age
Spearman's rho The score of positive attention to diet	Correlation coefficient Sig (2- tailed) N	1.000 . 377	.229 .000 377
Age	Correlation coefficient Sig (2- tailed) N	.229 .000 377	1.000 . 377

Table- Test of normality of the score of positive attention to diet and age				
		Kolmogorov- Smirnov		
	Age group	Statistic	df	Sig.
The score of positive attention to diet	18-30 years	.062	361	.002
	31-50 years	.170	16	.200

Table- Mann Whitney U test's statistics that to determine the differences between the score of positive attention to diet and age	
	the score of positive attention to diet
Mann Whitney U	1800.500
Wilcoxon W	67141.500
Z	-2.553
Asymp. Sig. (2-tailed)	.011

Table- Descriptives of the score of positive attention to diet and age				
			Statistic	Std. Error
the score of positive attention to diet	Mean		33.58	.305
	95% Confidence Interval for Mean	Lower Bound	32.98	
		Upper Bound	34.18	
	5% Trimmed Mean		33.62	
	Median		34.00	
	Variance		35.064	
	Std. Deviation		5.921	
	Minimum		18	
	Maximum		48	
	Range		30	
	Interquartile Range		9	
	Skewness		-.142	.126
	Kurtosis		-.402	.251
age	Mean		22.29	.217
	95% Confidence Interval for Mean	Lower Bound	21.87	
		Upper Bound	22.72	
	5% Trimmed Mean		21.64	
	Median		21.00	
	Variance		17.723	
	Std. Deviation		4.210	
	Minimum		18	
	Maximum		50	
	Range		32	
	Interquartile Range		3	
	Skewness		3.763	.126
	Kurtosis		17.476	.251

Table- Correlation between the score of international physical activity questionnaire and age of the students			
		Age	The score of international physical activity questionnaire
Spearman's rho Age	Correlation coefficient Sig (2- tailed) N	1.000 . 377	.018 .732 377
The score of international physical activity questionnaire	Correlation coefficient Sig (2- tailed) N	.018 .732 377	1.000 . 377

Table- Test of normality of the score of international physical activity levels and age of the students				
		Kolmogorov- Smirnov		
	Age group	Statistic	df	Sig.
The score of international physical activity levels	18-30 years	.133	361	.000
	31-50 years	.287	16	.001

Table- Descriptives of the score of international physical activity questionnaire and age				
			Statistic	Std. Error
age	Mean		22.29	.217
	95% Confidence Interval for Mean	Lower Bound	21.87	
		Upper Bound	22.72	
	5% Trimmed Mean		21.64	
	Median		21.00	
	Variance		17.723	
	Std. Deviation		4.210	
	Minimum		18	
	Maximum		50	
	Range		32	
	Interquartile Range		3	
	Skewness		3.763	.126
	Kurtosis		17.476	.251
the score of international physical activity questionnaire	Mean		3385.62	156.889
	95% Confidence Interval for Mean	Lower Bound	3077.13	
		Upper Bound	3694.11	
	5% Trimmed Mean		3096.61	
	Median		2514.00	
	Variance		9279538.434	
	Std. Deviation		3046.233	
	Minimum		0	
	Maximum		17010	
	Range		17010	
	Interquartile Range		3588	
	Skewness		1.402	.126
	Kurtosis		1.974	.251

Table- Descriptive statistics of the score of international physical activity questionnaire and age of the students					
	N	Minimum	Maximum	Mean	Std. Deviation
Age	377	18	50	22.29	4.210
The score of international physical activity questionnaire	371	0	17010	3385.62	3046.233
Valid N(listwise)	371				

Table- Test of normality of the score of positive attention to diet and sex				
		Kolmogorov- Smirnov		
	Sex	Statistic	df	Sig.
The score of positive attention to diet	Male	.062	150	.200
	Female	.076	277	.003

Table- Group statistics of the score of positive attention to diet and sex					
	Sex	N	Mean	Std. Deviation	Std. Error Mean
The score of positive attention to diet	Male	150	33.71	5.813	.475
	Female	227	33.49	6.003	.398

Table-Independent Sample Test for the score of positive attention to diet and sex										
		Levene's Test for Equality of Variences		t-test for Equality of Means						
		F	Sig.	t	df	Sig (2-tailed)	Mean difference	Std. Error Difference	%95 Confidence Interval of the difference	
									Lower	Upper
The score of attention to diet positive	Equal varience assumed	.252	.616	.349	375	.727	.218	.624	-1.009	1.444
	Equal varience not assumed			.351	326.198	.726	.218	.620	-1.001	1.437

Table- Descriptives of the score of positive attention to diet and sex					
sex				Statistic	Std. Error
the score of positive attention to diet	male	Mean		33.71	.475
		95% Confidence Interval for Mean	Lower Bound	32.77	
			Upper Bound	34.64	
		5% Trimmed Mean		33.74	
		Median		34.00	
		Variance		33.793	
		Std. Deviation		5.813	
		Minimum		19	
		Maximum		46	
		Range		27	
		Interquartile Range		8	
		Skewness		-.064	.198
		Kurtosis		-.289	.394
	female	Mean		33.49	.398
		95% Confidence Interval for Mean	Lower Bound	32.70	
			Upper Bound	34.27	
		5% Trimmed Mean		33.54	
		Median		34.00	
		Variance		36.039	
		Std. Deviation		6.003	
		Minimum		18	
		Maximum		48	
		Range		30	
		Interquartile Range		9	
		Skewness		-.187	.162
		Kurtosis		-.462	.322

Table- Test of normality of the score of international physical activity questionnaire and sex				
		Kolmogorov- Smirnov		
	Sex	Statistic	df	Sig.
The score of international physical activity questionnaire	Male	.099	150	.001
	Female	.163	277	.000

Table- Mann Whitney U test's statistics[a] that to determine the differences between the score of international physical activity questionnaire and sex	
	the score of international physical activity questionnaire
Mann Whitney U	13801.500
Wilcoxon W	39679.500
Z	-3.113
Asymp. Sig. (2-tailed)	.002
a. Grouping Variable: sex	

Table- Descriptives of the score of international physical activity questionnaire and sex					
sex				Statistic	Std. Error
the score of international physical activity questionnaire	male	Mean		3772.07	232.329
		95% Confidence Interval for Mean	Lower Bound	3312.98	
			Upper Bound	4231.15	
		5% Trimmed Mean		3551.61	
		Median		3224.00	
		Variance		8096490.398	
		Std. Deviation		2845.433	
		Minimum		0	
		Maximum		13680	
		Range		13680	
		Interquartile Range		3839	
		Skewness		1.059	.198
		Kurtosis		.841	.394
	female	Mean		3130.25	209.215
		95% Confidence Interval for Mean	Lower Bound	2717.99	
			Upper Bound	3542.51	
		5% Trimmed Mean		2789.86	
		Median		2310.00	
		Variance		9935950.507	
		Std. Deviation		3152.134	
		Minimum		0	
		Maximum		17010	
		Range		17010	
		Interquartile Range		2982	
		Skewness		1.646	.162
		Kurtosis		2.803	.322

Table- Test of normality of the score of positive attention to diet and ethnicity				
		Kolmogorov- Smirnov		
	Ethnic Group	Statistic	df	Sig.
The score of positive attention to diet	White	.062	313	.005
	Black or African	.136	18	.200
	Asian	.119	29	.200
	Other	.229	16	.024

Table- Kruskal Wallis test's statistics[a] that to determine the differences between the score of positive attention to diet and ethnicity	
	The score of positive attention to diet
Chi-Square	7.586
df	3
Asymp. Sig. (2-tailed)	.055
a. Grouping Variable: ethnic group	

Table- Descriptives of the score of positive attention to diet and ethnic group

ethnic group				Statistic	Std. Error
the score of positive attention to diet	white	Mean		33.19	.335
		95% Confidence Interval for Mean	Lower Bound	32.53	
			Upper Bound	33.85	
		5% Trimmed Mean		33.20	
		Median		34.00	
		Variance		35.192	
		Std. Deviation		5.932	
		Minimum		18	
		Maximum		48	
		Range		30	
		Interquartile Range		8	
		Skewness		-.085	.138
		Kurtosis		-.474	.275
	black or african	Mean		35.11	1.734
		95% Confidence Interval for Mean	Lower Bound	31.45	
			Upper Bound	38.77	
		5% Trimmed Mean		35.51	
		Median		34.00	
		Variance		54.105	
		Std. Deviation		7.356	
		Minimum		18	
		Maximum		45	
		Range		27	
		Interquartile Range		10	
		Skewness		-.534	.536
		Kurtosis		.069	1.038

Table- Descriptives of the score of positive attention to diet and ethnic group

	asian	Mean		35.69	.880
		95% Confidence Interval for Mean	Lower Bound	33.89	
			Upper Bound	37.49	
		5% Trimmed Mean		35.71	
		Median		36.00	
		Variance		22.436	
		Std. Deviation		4.737	
		Minimum		26	
		Maximum		45	
		Range		19	
		Interquartile Range		7	
		Skewness		-.210	.434
		Kurtosis		-.146	.845
	other	Mean		35.31	1.241
		95% Confidence Interval for Mean	Lower Bound	32.67	
			Upper Bound	37.96	
		5% Trimmed Mean		35.35	
		Median		34.00	
		Variance		24.629	
		Std. Deviation		4.963	
		Minimum		25	
		Maximum		45	
		Range		20	
		Interquartile Range		7	
		Skewness		.225	.564
		Kurtosis		.451	1.091

Table- Test of normality of the score of international physical activity questionnaire and ethnicity				
		Kolmogorov- Smirnov		
	Ethnic Group	Statistic	df	Sig.
The score of international physical activity questionnaire	White	.140	313	.000
	Black or African	.262	18	.002
	Asian	.161	29	.052
	Other	.169	16	.200

Table- Kruskal Wallis test's statistics[a] that to determine the differences between the score of international physical activity questionnaire and ethnicity	
	the score of positive attention to diet
Chi-Square	6.946
df	3
Asymp. Sig. (2-tailed)	.074
a. Grouping Variable: ethnic group	

Table- Descriptives of the score of international physical activity questionnaire and ethnic group

ethnic group				Statistic	Std. Error
the score of international physical activity questionnaire	white	Mean		3554.67	176.950
		95% Confidence Interval for Mean	Lower Bound	3206.50	
			Upper Bound	3902.83	
		5% Trimmed Mean		3267.86	
		Median		2679.00	
		Variance		9800474.396	
		Std. Deviation		3130.571	
		Minimum		0	
		Maximum		17010	
		Range		17010	
		Interquartile Range		3669	
		Skewness		1.369	.138
		Kurtosis		1.809	.275
	black or african	Mean		2348.50	565.712
		95% Confidence Interval for Mean	Lower Bound	1154.95	
			Upper Bound	3542.05	
		5% Trimmed Mean		2212.44	
		Median		1566.00	
		Variance		5760542.382	
		Std. Deviation		2400.113	
		Minimum		0	
		Maximum		7146	
		Range		7146	
		Interquartile Range		3012	
		Skewness		1.156	.536
		Kurtosis		-.082	1.038

Table- Descriptives of the score of international physical activity questionnaire and ethnic group				
	asian	Mean		2591.45	486.528
		95% Confidence Interval for Mean	Lower Bound	1594.84	
			Upper Bound	3588.06	
		5% Trimmed Mean		2304.92	
		Median		1920.00	
		Variance		6864585.970	
		Std. Deviation		2620.035	
		Minimum		0	
		Maximum		11250	
		Range		11250	
		Interquartile Range		3205	
		Skewness		1.679	.434
		Kurtosis		3.394	.845
	other	Mean		2664.19	599.268
		95% Confidence Interval for Mean	Lower Bound	1386.88	
			Upper Bound	3941.50	
		5% Trimmed Mean		2498.21	
		Median		2391.00	
		Variance		5745948.163	
		Std. Deviation		2397.071	
		Minimum		0	
		Maximum		8316	
		Range		8316	
		Interquartile Range		2891	
		Skewness		1.126	.564
		Kurtosis		.988	1.091

Table- Test of normality of the score of positive attention to diet and level of study				
	Level of Study	Kolmogorov- Smirnov		
		Statistic	df	Sig.
The score of positive attention to diet	4	.082	41	.200
	5	.099	36	.200
	6	.069	240	.007
	Master's degree	.106	54	.196
	Research degree	.172	6	.200

Table- Correlation between the score of positive attention to diet and level of study			
		Level of study	The score of positive attention to diet
Spearman's rho Level of study	Correlation coefficient Sig (2- tailed) N	1.000 . 377	.136 .008 377
The score of positive attention to diet	Correlation coefficient Sig (2- tailed) N	.136 .008 377	1.000 . 377

Table- Descriptives of the score of positive attention to diet and level of study				
level of study				Statistic	Std. Error
the score of positive attention to diet	4	Mean		32.59	.964
		95% Confidence Interval for Mean	Lower Bound	30.64	
			Upper Bound	34.53	
		5% Trimmed Mean		32.81	
		Median		32.00	
		Variance		38.099	
		Std. Deviation		6.172	
		Minimum		18	
		Maximum		42	
		Range		24	
		Interquartile Range		10	
		Skewness		-.356	.369
		Kurtosis		-.486	.724
	5	Mean		34.64	.832
		95% Confidence Interval for Mean	Lower Bound	32.95	
			Upper Bound	36.33	
		5% Trimmed Mean		34.68	
		Median		34.50	
		Variance		24.923	
		Std. Deviation		4.992	
		Minimum		26	
		Maximum		43	
		Range		17	
		Interquartile Range		9	
		Skewness		-.133	.393
		Kurtosis		-1.044	.768

Table- Descriptives of the score of positive attention to diet and level of study				
	6	Mean	32.84	.363
		95% Confidence Interval for Mean — Lower Bound	32.13	
		95% Confidence Interval for Mean — Upper Bound	33.56	
		5% Trimmed Mean	32.82	
		Median	33.00	
		Variance	31.615	
		Std. Deviation	5.623	
		Minimum	18	
		Maximum	48	
		Range	30	
		Interquartile Range	8	
		Skewness	-.031	.157
		Kurtosis	-.281	.313
	Master's degree	Mean	36.20	.911
		95% Confidence Interval for Mean — Lower Bound	34.38	
		95% Confidence Interval for Mean — Upper Bound	38.03	
		5% Trimmed Mean	36.52	
		Median	37.50	
		Variance	44.807	
		Std. Deviation	6.694	
		Minimum	19	
		Maximum	46	
		Range	27	
		Interquartile Range	8	
		Skewness	-.630	.325
		Kurtosis	-.058	.639

Table- Descriptives of the score of positive attention to diet and level of study				
	Research degree	Mean		39.67	1.308
		95% Confidence Interval for Mean	Lower Bound	36.30	
			Upper Bound	43.03	
		5% Trimmed Mean		39.57	
		Median		39.50	
		Variance		10.267	
		Std. Deviation		3.204	
		Minimum		36	
		Maximum		45	
		Range		9	
		Interquartile Range		5	
		Skewness		.780	.845
		Kurtosis		.682	1.741

Table- Test of normality of the score of international physical activity levels and level of study				
	Level of Study	Kolmogorov- Smirnov		
		Statistic	df	Sig.
The score of international physical activity questionnaire	4	.145	41	.029
	5	.216	36	.000
	6	.139	240	.000
	Master's degree	.122	54	.042
	Research degree	.280	6	.156

Table- Correlation between the score of international physical activity questionnaire and level of study			
		Level of study	The score of international physical activity questionnaire
Spearman's rho Level of study	Correlation coefficient Sig (2- tailed) N	1.000 . 377	-.004 .934 377
The score of international physical activity questionnaire	Correlation coefficient Sig (2- tailed) N	.004 .934 377	1.000 . 377

Table- Descriptives of the score of international physical activity questionnaire and level of study

level of study				Statistic	Std. Error
the score of international physical activity questionnaire	4	Mean		3173.83	431.410
		95% Confidence Interval for Mean	Lower Bound	2301.92	
			Upper Bound	4045.74	
		5% Trimmed Mean		2963.83	
		Median		2479.00	
		Variance		7630700.995	
		Std. Deviation		2762.372	
		Minimum		0	
		Maximum		11676	
		Range		11676	
		Interquartile Range		4058	
		Skewness		1.069	.369
		Kurtosis		.826	.724
	5	Mean		3640.97	613.040
		95% Confidence Interval for Mean	Lower Bound	2396.43	
			Upper Bound	4885.51	
		5% Trimmed Mean		3374.49	
		Median		2092.50	
		Variance		13529451.113	
		Std. Deviation		3678.240	
		Minimum		0	
		Maximum		12156	
		Range		12156	
		Interquartile Range		3918	
		Skewness		1.359	.393
		Kurtosis		.634	.768

Table- Descriptives of the score of international physical activity questionnaire and level of study				
	6	Mean	3453.93	199.477
		95% Confidence Interval for Mean — Lower Bound	3060.98	
		95% Confidence Interval for Mean — Upper Bound	3846.89	
		5% Trimmed Mean	3153.73	
		Median	2662.00	
		Variance	9549857.226	
		Std. Deviation	3090.284	
		Minimum	0	
		Maximum	17010	
		Range	17010	
		Interquartile Range	3524	
		Skewness	1.492	.157
		Kurtosis	2.502	.313
	Master's degree	Mean	3179.91	372.039
		95% Confidence Interval for Mean — Lower Bound	2433.69	
		95% Confidence Interval for Mean — Upper Bound	3926.12	
		5% Trimmed Mean	3020.12	
		Median	2535.00	
		Variance	7474304.086	
		Std. Deviation	2733.917	
		Minimum	0	
		Maximum	10290	
		Range	10290	
		Interquartile Range	3222	
		Skewness	.889	.325
		Kurtosis	-.134	.639

Table- Descriptives of the score of international physical activity questionnaire and level of study

Research degree	Mean		2419.33	787.396
	95% Confidence Interval for Mean	Lower Bound	395.27	
		Upper Bound	4443.40	
	5% Trimmed Mean		2347.48	
	Median		1626.00	
	Variance		3719953.067	
	Std. Deviation		1928.718	
	Minimum		462	
	Maximum		5670	
	Range		5208	
	Interquartile Range		3072	
	Skewness		1.121	.845
	Kurtosis		.418	1.741

Table- Test of normality of BMI and consuming snack instead of eating regular meals				
		Kolmogorov- Smirnov		
	Consuming snack instead of regular meals	Statistic	df	Sig.
Body mass index	Most of the time	.094	40	.200
	Some of the time	.106	219	.000
	Almost Never	.103	112	.005

Table- Kruskal Wallis test's statistics[a] that to determine the differences between BMI and consuming snack instead of eating regular meals	
	the score of positive attention to diet
Chi-Square	5.014
df	2
Asymp. Sig. (2-tailed)	.082
a. Grouping Variable: Consuming snack instead of eating regular meals	

Table- Descriptives of BMI and consuming snack instead of eating regular meals

snack instead of eating regular meals				Statistic	Std. Error
body mass index	most of the time	Mean		23.0210	.53902
		95% Confidence Interval for Mean	Lower Bound	21.9308	
			Upper Bound	24.1113	
		5% Trimmed Mean		22.8823	
		Median		22.8571	
		Variance		11.622	
		Std. Deviation		3.40907	
		Minimum		17.10	
		Maximum		32.72	
		Range		15.62	
		Interquartile Range		4.90	
		Skewness		.559	.374
		Kurtosis		.377	.733
	some of the time	Mean		24.6999	.33734
		95% Confidence Interval for Mean	Lower Bound	24.0350	
			Upper Bound	25.3648	
		5% Trimmed Mean		24.2195	
		Median		23.4493	
		Variance		24.922	
		Std. Deviation		4.99222	
		Minimum		17.19	
		Maximum		47.75	
		Range		30.56	
		Interquartile Range		5.54	
		Skewness		1.671	.164
		Kurtosis		3.965	.327

Table- Descriptives of BMI and consuming snack instead of eating regular meals					
	almost never	Mean		23.6317	.38003
		95% Confidence Interval for Mean	Lower Bound	22.8787	
			Upper Bound	24.3848	
		5% Trimmed Mean		23.3173	
		Median		22.8339	
		Variance		16.176	
		Std. Deviation		4.02191	
		Minimum		17.53	
		Maximum		37.55	
		Range		20.02	
		Interquartile Range		4.72	
		Skewness		1.230	.228
		Kurtosis		1.786	.453

Table- Test of normality of the score of positive attention to diet and consuming snack instead of eating regular meals				
		Kolmogorov- Smirnov		
	Consuming snack instead of regular meals	Statistic	df	Sig.
The score of positive attention to diet	Most of the time	.102	40	.200
	Some of the time	.061	223	.044
	Almost Never	.091	114	.021

Table- Kruskal Wallis test's statistics[a] that to determine the differences between the score of positive attention to diet and consuming snack instead of eating regular meals	
	the score of positive attention to diet
Chi-Square	61.813
df	2
Asymp. Sig. (2-tailed)	.000
a. Grouping Variable: Consuming snack instead of eating regular meals	

Table- Descriptives of the score of positive attention to diet and snack instead of eating regular meals

snack instead of eating regular meals				Statistic	Std. Error
the score of positive attention to diet	most of the time	Mean		27.70	.968
		95% Confidence Interval for Mean	Lower Bound	25.74	
			Upper Bound	29.66	
		5% Trimmed Mean		27.39	
		Median		27.50	
		Variance		37.497	
		Std. Deviation		6.124	
		Minimum		18	
		Maximum		46	
		Range		28	
		Interquartile Range		8	
		Skewness		.687	.374
		Kurtosis		.779	.733
	some of the time	Mean		33.24	.365
		95% Confidence Interval for Mean	Lower Bound	32.52	
			Upper Bound	33.96	
		5% Trimmed Mean		33.18	
		Median		33.00	
		Variance		29.770	
		Std. Deviation		5.456	
		Minimum		20	
		Maximum		45	
		Range		25	
		Interquartile Range		8	
		Skewness		.168	.163
		Kurtosis		-.502	.324

Table- Descriptives of the score of positive attention to diet and snack instead of eating regular meals

	almost never	Mean		36.29	.472
		95% Confidence Interval for Mean	Lower Bound	35.35	
			Upper Bound	37.22	
		5% Trimmed Mean		36.48	
		Median		37.00	
		Variance		25.376	
		Std. Deviation		5.037	
		Minimum		22	
		Maximum		48	
		Range		26	
		Interquartile Range		6	
		Skewness		-.566	.226
		Kurtosis		.719	.449

Table- Mann Whitney U test's statistics[a] that to determine the differences between perceived weight and sex

	Percieved weight
Mann Whitney U	10187.500
Wilcoxon W	36065.500
Z	-6.876
Asymp. Sig. (2-tailed)	.000
a. Grouping Variable: sex	

Table- Descriptives of perceived weight and sex					
sex				Statistic	Std. Error
feeling weight	male	Mean		2.79	.105
		95% Confidence Interval for Mean	Lower Bound	2.59	
			Upper Bound	3.00	
		5% Trimmed Mean		2.77	
		Median		3.00	
		Variance		1.642	
		Std. Deviation		1.281	
		Minimum		1	
		Maximum		5	
		Range		4	
		Interquartile Range		2	
		Skewness		.103	.198
		Kurtosis		-.918	.394
	female	Mean		1.90	.061
		95% Confidence Interval for Mean	Lower Bound	1.78	
			Upper Bound	2.02	
		5% Trimmed Mean		1.84	
		Median		2.00	
		Variance		.844	
		Std. Deviation		.919	
		Minimum		1	
		Maximum		5	
		Range		4	
		Interquartile Range		2	
		Skewness		.756	.162
		Kurtosis		.141	.322

Table- Mann Whitney U test's statistics[a] that to determine the differences between the frequency of diet applied in the past six months and sex	
	the frequency of diet applied in the past six months
Mann Whitney U	12329.500
Wilcoxon W	23654.500
Z	-4.850
Asymp. Sig. (2-tailed)	.000
a. Grouping Variable: sex	

Table- Descriptives of the frequency of diet applied in the past six months and sex					
sex				Statistic	Std. Error
In the past six months, number of diets applied	male	Mean		1.61	.075
		95% Confidence Interval for Mean	Lower Bound	1.47	
			Upper Bound	1.76	
		5% Trimmed Mean		1.51	
		Median		1.00	
		Variance		.843	
		Std. Deviation		.918	
		Minimum		1	
		Maximum		4	
		Range		3	
		Interquartile Range		1	
		Skewness		1.427	.198
		Kurtosis		1.022	.394
	female	Mean		2.11	.069
		95% Confidence Interval for Mean	Lower Bound	1.97	
			Upper Bound	2.24	
		5% Trimmed Mean		2.06	
		Median		2.00	
		Variance		1.068	
		Std. Deviation		1.034	
		Minimum		1	
		Maximum		4	
		Range		3	
		Interquartile Range		2	
		Skewness		.393	.162
		Kurtosis		-1.103	.322

Appendix 2 Questionnaire

QUESTIONNAIRE

1- What sex are you?
□ Male □ Female

2- How old are you? ____
3- Which subject are you studying? ____
4- What level are you studying?
□ 4 □ 5 □ 6 □ Master's degree □ Research degree
5- What ethnic group best describes you?
□ White

□ Black or African

□ Asian

□ Other. What? ____

6- How tall are you? _____cm _____ feet _____& inches
7- How much do you weight? _____kilogram _____ stone (st) _____ pounds (lbs)
8- How do you feel about your weight?
□ Would like to lose at least 5 kilograms

□ Would like to lose 1-4 kilograms

□ My weight is about right

□ Would like to gain 1-4 kilograms

□ Would like to gain at least 5 kilograms

9- Are you watching TV while you are eating?
□ Most of the time □ Some of the time □ Almost never

10- Do you usually snack instead of eating regular meals?
□ Most of the time □ Some of the time □ Almost never

11- Do you skip meals?
□ Most Days □ Some Days □ Almost Never

12- How many meals do you eat per day?
□ 2 □ 3 □ 4 □ 5 □ Other. What? ____

13- How often do you skip breakfast?
□ Most Mornings □ Some Mornings □ Almost Never
14- How often do you skip lunch?
□ Most Afternoons □ Some Afternoons □ Almost Never
15- How often do you skip dinner?
□ Most Evenings □ Some Evenings □ Almost Never

16- DO YOU PAY ATTENTION TO:	**A Lot**	**Some**	**Never**
a. Seeing that your diet is healthy?	□	□	□
b. Keeping down the amount of salt you eat?	□	□	□
c. Eating only as much as your body really needs?	□	□	□
d. Keeping down the amount of fat you eat?	□	□	□
e. Eating in a healthy way even when you're with friends?	□	□	□
f. Eating healthy snacks like fruit instead of candy?	□	□	□
g. Eating foods that are baked or boiled rather than fried?	□	□	□
h. Do you ever eat more than you really need to?	□	□	□
ı. Do you ever eat even when you're not really hungry?	□	□	□
j. Do you ever keep on eating even after you feel full?	□	□	□
k. Do you ever eat because you're upset about something?	□	□	□
l. Do you ever eat just because you're bored?	□	□	□
m. Do you consume about 2.5-3 liters of water a day?	□	□	□
n. Do you ever eat sugary food when you feel stressed out?	□	□	□
p. Do you ever feel the need to eat at night?	□	□	□
q. Do you ever have a snack while watching a movie?	□	□	□
r. Do you ever read the labels when you buy foods?	□	□	□

17- In the past six months, about how many times have you started a diet to lose weight?

□ Never □ Once □ 2-3 Times □ 4 or More Times

18- Are you on a diet to lose weight now?

□ No □ Yes

19- In the past six months, have you ever used diet pills or laxatives to help you to lose weight or to stay thin?

□ Never □ Once or Twice □ Several Times □ Often

20- In the past six months, have you ever made yourself throw up as a way to lose weight or to stay thin?

□ Never □ Once or Twice □ Several Times □ Often

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   _____ **days per week**

   ☐ No vigorous physical activities → ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

   _____ **hours per day**

   _____ **minutes per day**

   ☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   _____ **days per week**

   ☐ No moderate physical activities → ***Skip to question 5***

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

   _____ **hours per day**

   _____ **minutes per day**

   ☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → ***Skip to question 7***

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

This is the end of the questionnaire, thank you for participating.

Appendix 3 Participant Information Sheet

University of Chester

Participant information sheet

BMI (body mass index) and relationship with nutrition behaviour and physical activity levels of university students in the United Kingdom

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this.

What is the purpose of the study?

The purpose of the quantitative study is to explore the relationship between the level of BMI (body mass index) in University of Chester students according to their habits of nutrition and physical activity levels.

Why have I been chosen?
You have been chosen because you are a university student.

Do I have to take part?
It is up to you to decide whether or not to take part. If you decide to take part you will be given this information sheet to keep and be asked to complete questionnaire. Consent will be implied through completion of the questionnaire. If you decide to take part you are still free to withdraw at any time and without giving a reason. A decision to withdraw at any time, or a decision not to take part, will not affect you in any way.

What will happen to me if I take part?
You will be given a questionnaire. It will take approximately 5-10 minutes to complete. It will ask you about your nutritional habits, level of physical activity and anthropometric information.

What are the possible disadvantages and risks of taking part?
There are no disadvantages or risks foreseen in taking part in the study. . If you are concerned about your health after the questionnaire, you can check these websites www.nhs.uk/pages/home.aspx, www.nhs.uk/change4life-beta/be-food-smart#bJqIslLQV7tiKYK3.97 .

What are the possible benefits of taking part?
By taking part, you will be contributing to determine the nutritional habits and exercise levels that cause obesity; It is effective in taking measures to prevent obesity and related chronic diseases in the future.

What if something goes wrong?
If you wish to complain or have any concerns about any aspect of the way you have been approached or treated during the course of this study, please contact Dean of the Faculty of Medicine, Dentistry and Life Sciences, University of Chester, Parkgate Road, Chester, CH1 4BJ, 01244 513055.

Will my taking part in the study be kept confidential?
All information which is collected about you during the course of the research will be kept strictly confidential so that only the researcher carrying out the research will have access to such information.

Participants should note that data collected from this project may be retained and published in an anonymised form. By agreeing to participate in this project, you are consenting to the retention and publication of data.

What will happen to the results of the research study?
The results will be written up into a dissertation for my final project of my MSc. Individuals who participate will not be identified in any subsequent report or publication.

Who is organising the research?
The research is conducted as part of a MSc in Exercise & Nutrition Science within the Department of Clinical Sciences & Nutrition at the University of Chester. The study is organised with supervision from the department, by Fadime Merve Oguz, an MSc student.

Who may I contact for further information?
If you would like more information about the research before you decide whether or not you would be willing to take part, please contact:

Fadime Merve Oguz. 1622508@chester.ac.uk.

Thank you for your interest in this research.

Appendix 4 Ethical approval letter from Faculty of Medicine, Dentistry and Life Sciences Research Ethics Committee at the University of Chester

Faculty of Medicine, Dentistry and Life Sciences
Research Ethics Committee

frec@chester.ac.uk

Monday, 10 April 2017

Fadime Merve Oguz
5 Brennus Place
St Martins Way
Chester
CH1 2NE

Dear Fadime,

Study title: BMI (body mass index) and relationship with nutrition behaviour and physical activity levels of university students in the United Kingdom
FREC reference: 1255/17/FO/CSN
Version number: 2

Thank you for sending your application to the Faculty of Medicine, Dentistry and Clinical Sciences Research Ethics Committee for review.

I am pleased to confirm ethical approval for the above research, provided that you comply with the conditions set out in the attached document, and adhere to the processes described in your application form and supporting documentation. **However, the Committee would like to make the following recommendations:**

- If posters are to be put up in communal areas of university buildings, approval will be required from the Student Union or relevant departments.
- Anthropometric measures should be changed in the PIS to height and weight as anthropometric will mean very little to the general population.
- If a department (i.e. Clinical Sciences and Nutrition) Facebook page or group is being used, approval with be required from the Research and Knowledge Transfer Office.

Please forward an electronic copy of your amendments to frec@chester.ac.uk

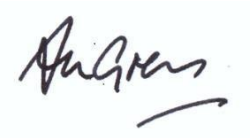
The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
Application Form	1	Feb 2017
Appendix 1 – Summary CV for Lead Researcher	1	Feb 2017
Appendix 2 – Participant Information Sheet (PIS)	2	Mar 2017
Appendix 3 – Hypotheses	1	Feb 2017
Appendix 4 – List of References	1	Feb 2017
Appendix 5 – Questionnaires	2	Mar 2017
Appendix 6 – Study used to determine number of participants	1	Feb 2017
Appendix 7 – Lead researcher's signature	1	Feb 2017
Appendix 8 – Risk assessment forms	1	Feb 2017
Response to FREC request for further information or clarification	1	Mar 2017

Please note that this approval is given in accordance with the requirements of English law only. For research taking place wholly or partly within other jurisdictions (including Wales, Scotland and Northern Ireland), you should seek further advice from the Committee Chair / Secretary or the Research and Knowledge Transfer Office and may need additional approval from the appropriate agencies in the country (or countries) in which the research will take place.

With the Committee's best wishes for the success of this project.

Yours sincerely,



Professor Ben Green
Chair, Faculty Research Ethics Committee

Enclosures: Standard conditions of

approval. Cc. Supervisor